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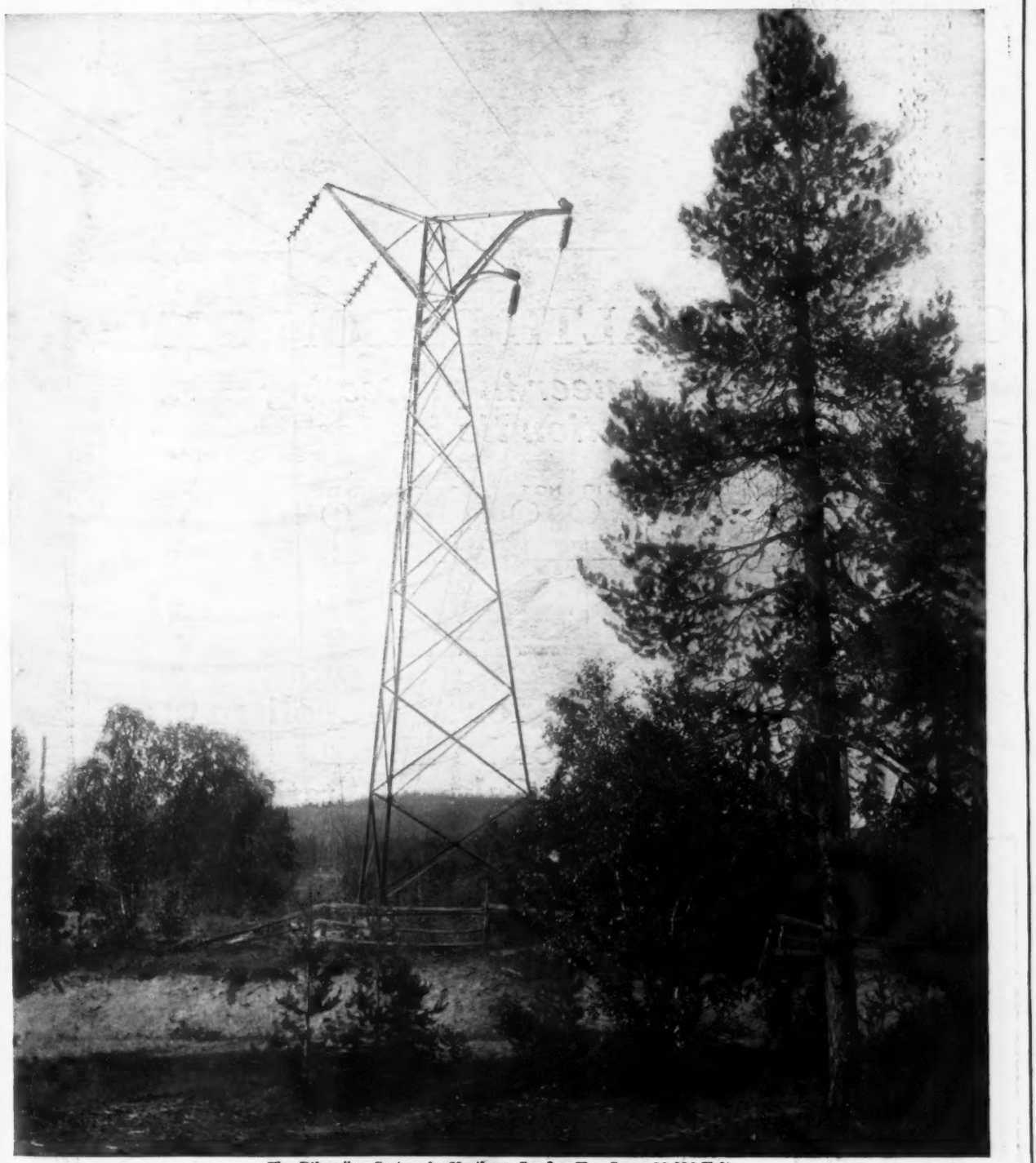
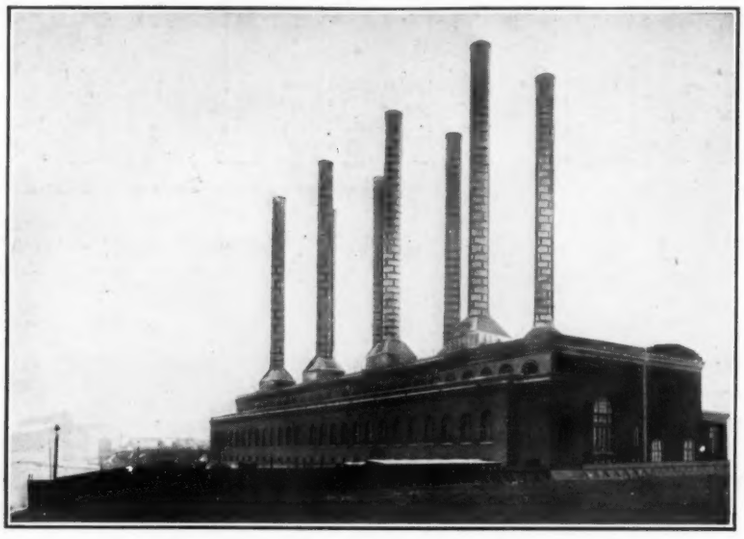


The Riksgräns System in Northern Sweden Has Some 80,000-Volt Tower Structures of Unusual Design

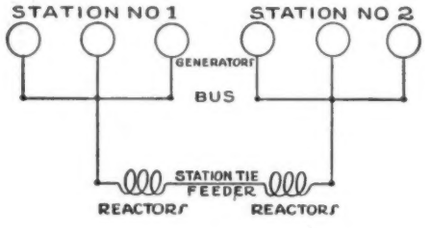
Water Powers of Norway — General Tripp Answers Governor Smith on New York Water Powers — Post Office Illumination Recommendations — Changing a System to 60 Cycles — Major Changes in National Electrical Code — Electric Plowing — The Pallophotophone



Quarry Street Station Rated at 84,000 KW.

COMMONWEALTH EDISON COMPANY

—*Pioneer in protecting station tie feeder*



Repeat Orders Placed for Metropolitan Reactors for both Quarry and Calumet Stations

In the advertising pages of the August issue of the *Electric Journal* and the August 12th issue of the ELECTRICAL WORLD, the Metropolitan Device Corporation of Brooklyn, N. Y. stated that Metropolitan reactors were used as standard equipment throughout, in the Queenston Hydro Electric plant. This was an error for which the advertising department of the *Electric Journal* was responsible. The Queenston reactors were furnished by the Canadian General Electric Company of Toronto, Canada.

Protection to station tie feeders is as important as protection to generators.

An excellent way of arranging reactance coils upon such circuits is the one adopted by the Commonwealth Edison Company at Chicago, Ill., shown in the illustration above. This company installs one-half the total reactance in each one of the two stations intertied with each other.

METROPOLITAN DEVICE CORPORATION
1250 Atlantic Avenue, Brooklyn, N. Y.

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

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W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

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National Versus State Rights in Water Power

NOT until the United States Supreme Court passes on the question will the rights of the federal and state governments to the water powers of navigable streams be definitely and finally fixed. The federal water-power law of 1920 is generally regarded as a constructive measure. Under it, as the record shows, water-power development has received great impetus. Not only does the law satisfy the conservationists, but it favors state and municipal governments without discouraging private corporations from also engaging in the business, which is a real achievement. That Governor Smith of New York should question the constitutionality of the federal law ought not to give the industry much concern. He is clearly within his rights in so doing, and since the highest court of the land will some day have to pass on the matter the issue might just as well be raised now and by a state which can well present and amply defend its case.

It is none the less an unfortunate condition that pending the outcome of the litigation water-power development in New York will be under a cloud and prospective investors in hydro-electric properties will be discouraged, if not actually deterred, from buying the securities of such companies, much to the detriment of the electrical industry and the growth of many a community. But such temporary handicaps cannot be avoided. They serve the course of orderly justice, and, however irritating they may be, they do not alter the fact that the American people are set on having their water powers developed and no governor or state can alter that determination or stay that program.

This, of course, has nothing to do with state development of water power in New York. That is a horse of another color. What water power is now developed in the state, and it is an appreciable amount, greater than is developed in the whole of Sweden, has been due to private enterprise, and private enterprise is still willing to engage in the work if it receives half a chance. Under the circumstances, therefore, state development is not only uncalled for, but is hardly likely to be sanctioned by either the voters or their representatives at Albany. The Empire State may be all sorts of things, but it is still the Empire State, and its interests are too important and too complex to permit it to be shoved off the well-built road of experience and sanity into the unpaved byways of adventure and socialism.

William Edward Mitchell

An electrical engineer of ability and force whose power to organize and to inspire loyalty and enthusiasm has made him an influence in the public utility world.

TO BE the leader in the design, erection and operation of an electric power system totaling over 200,000 kw. in generator capacity, with 1,500 miles of transmission lines and with particular problems due to its phenomenally rapid growth, shows the ability of a man as an electrical engineer. But to be the recognized human leader to whom the individuals in his organization, from the top to the bottom, turn in time of trouble—personal or otherwise—marks a much larger ability. Such a man is William E. Mitchell, assistant general manager of the Alabama Power Company and one to whom the organization looks as a leading spirit.

Mr. Mitchell was born in Massachusetts, in 1882, of Scotch ancestors. After graduation in electrical engineering at the Massachusetts Institute of Technology, he spent two years in the test course of the General Electric Company, then six years in Brazil with two large power companies in construction and operation, becoming the electrical engineer of the Bahia Tramway, Light & Power Company.

In 1912 he removed to Alabama, where the Alabama Power Company was being organized, and was made the electrical engineer of that company during construction, and then operating manager as soon as the company's steam and hydro-electric plants were ready to deliver power. Mr. Mitchell continued to guide the destinies of the operating end of the company until the world war indicated the need for a strong man to direct the activities of the Anniston Steel Company, a subsidiary producing electric furnace steel for war purposes. Mr. Mitchell was made managing director of the steel company. After the termination of the war he returned to the Alabama Power Company as assistant general manager.

In the eleven years of its existence the Alabama Power Company has grown to be one of the first twenty largest power systems in America. In the building up of this magnificent property in an almost virgin territory William E. Mitchell played a very prominent part. He possesses the necessary physique, experience and magnetism to lead and inspire his organization. All the ruggedness and other traits of character which one associates with men who contend with the forces of nature in the mountains and rivers are his, and like most men who are of the pioneer type he is intensely human.

Mr. Mitchell has been active in National Electric Light Association work in the Southeastern Section, being a past-president and a member of various committees.

Editorial Comment

Electrical World, March 24, 1923

Volume 81 Number 12

A Co-operative Opportunity That Should Be Grasped

CONSPICUOUS among the opportunities for co-operation that the future of the electrical industry holds is the chance for increased mutual service between manufacturers and users of equipment. To utilize this opportunity to the full, manufacturers' engineers should be kept in the field to gain the viewpoint of operating, construction and maintenance engineers. Thus fortified, modifications of equipment can be made to meet operating conditions more effectively since the design will have a practical as well as a theoretical basis. On the other hand, many users of equipment will be wise enough frankly to relate their experiences and their troubles. In some cases operating companies can greatly help by permitting the use of their systems or equipment as was done by a number of companies last year. When this is done, the results of the co-operative study by maker and user should be made available to the entire industry and not confined to a favored few. Both manufacturer and operator will benefit considerably if operating conditions are outlined clearly and specifically in ordering equipment and if trouble with existing installations is both recorded and reported.

The Technique of Post Office Illumination

THE tardy but welcome awakening of the Post Office Department to the essential character of good lighting was celebrated editorially in the ELECTRICAL WORLD a few weeks ago. This week it is glad to put on record in more complete form the recommendations of the Public Health Service on the lighting of post offices that were made at the request of the department and are the evidence that its slumber is over. In many respects the report is a notable one—a signpost on the road of progress that cannot be disregarded. To a certain degree the lighting of post offices occupies a unique position in the art of artificial lighting, and this must be borne in mind in using the report as a guide to practice. Post office lighting is not, indeed, really comparable with those normal requirements of clerical work with which it is likely to be confused. In the first place, post office work involves two distinct working planes—horizontal and vertical—both of which must be brought to a suitable degree of illumination. This at once applies two limitations in luminaire design, a condition quite unusual and one that explains what would otherwise seem to be very needless detail of specification. Second, the work involves the speed element to a degree most exceptional in clerical work, and this in turn, as shown by many recent experiments, brings need for a much higher degree of illumination than would be needed, for example, in ordinary bookkeeping. Finally, the objects worked upon are varied and often extremely bad in color and contrast, thanks especially to the abominable window envelopes, which present a condition similar to the one caused by use of tracing cloth, notorious for requiring exceptionally strong lighting.

It is not surprising, therefore, to find a value of 10 foot-candles initial set as the standard for post office workers. Considering the conditions and the certainty of the standard falling presently to 7 or 8 foot-candles, the basis is none too high from the standpoint of real efficiency. Another commendable feature is that the specific brightness of the globes is kept low and linked to the light flux of the lamp, so that there may be no overloading of the globe for the sake of cheapness, a fault which seriously impairs the usefulness of many commercial units. The report is a piece of constructive work of real value to the art of lighting, and it deserves to be appreciated and acted upon.

Contrasts in Attitudes on Public Relations

CONTRASTS in the method of attacking the public relations problem were presented at the joint session of the recent conventions of the Oklahoma Utilities Association and Southwest Geographic Division, N. E. L. A. John W. Shartel in a few minutes' extemporaneous talk excoriated the public, the politicians, the legislators and the utility commissions for their unfair attitude toward utilities. Henry S. Ives, an insurance man, in what he frankly said was intended to be an alarmist effort, painted in somber colors all the possible horrors of state socialism in business. On the other hand, Labert St. Clair, in a homely little story of Aunt Sally Ann Dusenbury, the typical friend, confidente and indispensable village angel, painted the public as "just folks" who can be reached and touched by a little understanding human treatment. John W. Gleed, in an equally homely and forcible manner, emphasized the same thing and told his hearers that escape from too drastic state regulation and extreme political action lies entirely in the hands of utility men themselves, because in dealing with the American public they are simply meeting average human beings who are trying amid perplexing circumstances to be fair and to do the right thing. The method of helping the public to be decent and right is the method so little tried of "Do unto others as ye would they should do unto you."

Messrs. Shartel and Ives may have relieved their feelings and may have aroused a few who lay in lethargy; but Messrs. St. Clair and Gleed have caught a vision of the fact that in the hands of business men, and in their hands alone, lies the determination of the question of how far government will enter into business. Government is now in utility affairs principally because men early in the utility business—from the steam railroad to the central station—could not see that self-regulation is the only substitute for governmental regulation and that one or the other must exist.

Similar arguments apply in other fields of business,

and some of the recent occurrences in the commercial and industrial world, notably in the coal industry, furnish an interesting study as to why the governmental authorities get into business. Until business learns to practice self-regulation the march of government into business, with all its painful mistakes, inefficiency and economic blunders, will continue. Speeches such as those of Messrs. Shartel and Ives are likely only to add fuel to the flames. Why waste the energy? The attitude of Messrs. St Clair and Gleed represents the best thinking of progressive men in all utility fields.

Co-operation Will Hasten the Use of Electrical Energy on the Farm

STRIPPED of the excess verbiage with which it is sometimes surrounded, the problem of using electrical energy on the farm is purely an economic one. On the one hand, the electrical industry has a service to sell; it must be able to sell that service at a profit. On the other hand, the farmer wants to buy that service; he must be able to use it at a profit. The American farm is a producing agency and as such has its producing and sales problems. These problems are in no way different in principle from those of any other business; but in organization features the agricultural industry is different from others, since it consists of small units with all the limitations that small units must have when big problems are being faced.

The farmer, in spite of opinions to the contrary, is a real user of power. The best supply and use of this power is basically a technical problem. Other industries in the past quarter of a century have attained a development in the use of power that is a direct result of the degree to which it has been possible to bring the best of technical talent to bear on their problems; but the farmer has not had the advantage of tremendous business organizations and the consequent power to deal with technical and business problems in the most efficient way. This lack of individual ability to handle technical problems is being supplied by the development of the experimental stations and agricultural engineering schools of America. These have already done a tremendous technical work in the development of agriculture. With them must lie the burden of the research work involved in the solution of the entire problem of farm power. The electrical industry has much to offer to help in this work. The more it co-operates with the technical research agencies established for the benefit of agriculture, the more rapid will be the progress toward a final solution of the problem of the use of electrical energy on the farm.

Inductive Effect on Radio Receivers a Future Problem

IN THE last year the term "inductive interference" has taken on a new meaning of rather serious import. This time it is not the signal interests that are involved but the section of the general public which is making intensive use of the radio receiver. Physical hazards due to the installation of an antenna close to light and power lines were the trouble brought to the attention of the central-station operator in the first few months of the development. Now the novice is learning that, while static disturbances may be the explanation of a great many of his receiving troubles, some of the troubles styled static may be due to other causes. A number of cases have been noted where wise amateurs have taken a loop and a simple receiving set, located faults on a transmission or distribution system and asked the power company to eliminate them.

The seriousness of the situation is that the people affected represent an influential section of the public. As they find there are cases in which power circuits cause inductive effects they will, in ignorance, naturally lay other troubles to the same source. The suggestion of one utility operator that the existence of such trouble should not be admitted will not help the situation. Whether he wants to or not, the central-station operator must pay attention to this phase of radio development and keep the confidence of his public so that any cases of inductive effects will be reported to him first and he will have an opportunity to straighten them out or educate the complainant to the fact that there are other sources of trouble and also that there are some inductive effects that are normal and cannot be eliminated without serious curtailment of electric light and power service. The opportunity is now present to guide radio development and prevent interference questions from getting before public regulatory bodies. Ignoring them only makes them more acute with a slight postponement of the day of reckoning.

"Our Representative the Contractor"

THERE is nothing new in the idea that the contractor represents the central-station company at least as an indirect solicitor of business. But it is not so generally realized that many a new customer's ideas of the central-station organization are formed by the contractor's opinion of the utility. The contractor and his men enter a residence or a business establishment to install wiring, and very often a discussion of the local electric service company and its practices follows during the period of work. If the customer's contact with the utility has been confined to the application clerk, and if relations are not good between the electric company and the contractor, an initial prejudice may be formed in the consumer's mind which is very hard to dislodge.

In a community where the utility plays fairly with the contractor and vice versa the new customer starts with the impression that all is well with the local electrical industry. He may not put it into words, but this establishes a groundwork of confidence which encourages the purchase of electrical devices and the provision of a wiring installation somewhere nearly adequate to the local conditions and opportunities. There is still a vast amount of ignorance anent things electrical on the part of the public, and it is to the vital interest of the industry that local trade relations shall be excellent.

Where merchandising is done on a list-price basis, with fair dealing and open competition, good feeling is pretty sure to abound. Where the central station works in accord with the contractor, taking into consideration his views when framing its service rules, giving him when feasible an opportunity to share in special appliance campaigns, and in general treating him as "one of the family," popular confidence also in the local electrical interests is enhanced and prosperity is stimulated. An embittered contractor, on the other hand, constantly struggling to make both

ends meet across the gap of price cutting or other concessions in a community where the electrical league spirit has found no outlet, can do as much harm to the electrical trade as a "sore" utility employee. Square dealing between all branches of the industry is its own justification, but in realizing this central-station executives will do well to ponder the contact of the contractor-dealer with the customer and its potentialities for good.

Shall the Central Stations Establish a Research Organization?

THE central-station industry has attained a velocity which gives it a tremendous momentum. Every operating company is strained almost to the breaking point to satisfy the demands for light and power service. Every company rushes from the completion of a generating station to the installation of new feeders, transformers and substations in order to keep pace with the rapid increases in load. Clauses in rate systems are added or changed overnight to take advantage of new applications of electricity and new conditions in the ever-expanding loads. The manufacturers continually bring out new or more efficient apparatus. Is it any wonder that men in the operating organization find their time fully occupied with the daily operating duties?

But the rapid growth and expansion of central-station properties and operations inevitably have brought about conditions on the systems which do not result in economical or the most efficient operation. Men engaged in building new stations and new lines have little time to study the efficiency or economy of the existing systems after they are installed and still less time to engage in developmental research for future needs. Yet load conditions change on the old installations; power transformers become overloaded or underloaded; feeders become too large or too small for the loads they carry; the distribution layout becomes inadequate or cumbersome as the population shifts in locality or occupation; the power stations contain equipment that might economically be replaced by new and more efficient apparatus; substation apparatus gets obselete rapidly, and practice changes as new developments occur. Changing needs and advanced technical information make possible research developments that would secure more efficient operation.

Just recently there has been a very decided recognition of the conditions outlined, and a marked trend toward greater efficiency in operation is noticed. In most cases the management has recognized that the operating staff is too busy with necessary, even if semi-routine, duties to devote any time to efficiency studies, and in many cases a new department has been established for carrying out studies designed to secure greater efficiency, more economical distribution of equipment or better apparatus for obtaining desired results. In some companies this department devotes its energies to power production, studies the power-station equipment in the existing plants and works out the design problems for new stations in so far as they deal with thermodynamics; in other cases certain men study the distribution system to determine the most economical layout for copper and transformers, and in still other instances men are detailed to study problems connected with the operation of some particular part of the system. In nearly every instance these special-duty men are relieved of operating routine and are selected for their technical ability. They have proved their value and become increasingly important as a system grows in magnitude. In one instance college professors are used to advantage during the summer; in other organizations specially selected technical men work under the direction of the chief executive. These men prepare special reports on power-factor-corrective apparatus or rates, transformer capacity for industrial installations, relative merits of distribution systems, economic layouts for feeders and substations, and also do some research work in testing out new equipment developed by manufacturers, or even develop equipment for special operating requirements.

This move has a real importance and is warranted by existing conditions. Major economies are being obtained on many systems and the extent of this movement cannot be gaged. It is a good time to question whether the specialists in the ranks of the manufacturers should longer be called upon to serve as the research men and technical advisers for the operating companies—whether they cannot apply their skill much more effectively to the development of new equipment or technique. Furthermore, the properties on which the research problems exist are usually large and widely scattered and are complicated by local conditions which make it imperative that the special problem men be familiar with the system continuously. Many of the problems are largely economic and involve confidential information.

It has been definitely recommended by some who are studying the question that steps be taken to develop a co-operative research organization, backed and financed by the central-station industry, which will apply itself to the technical problems. Certainly, some method of advancing co-operative work along such lines would prove of advantage. If such plan is to be carried out, thought should be devoted to securing development along sound lines and steps can be taken immediately to avoid duplication of effort on the part of individual companies.

What Does Appliance Servicing Cost the Central Station?

ONE of the problems under consideration in central-station commercial circles in many parts of the country is how to reduce the cost of appliance servicing. In too many cases this has been overlooked, and the need of more data upon the subject is undeniable. Practice varies considerably in operating companies as to repair cost accounting, rules as to guarantees, minimum billing and no billing at all! One important operating syndicate is now making a thorough study of the whole subject in the hope of arriving at some real costs and thereby sounding the safe depths of the commercial channel for future passage and a standardized course, if feasible. It is a safe bet that appliance servicing costs more than is ordinarily credited to it, not only in the central-station field but among electrical retailers in general. In some cases efforts appear to be fairly successful along the line of combining servicing work with other customer-contact activities; in other communities the public accepts minimum charges for repairs as a matter of course. Further steps toward assembling and studying servicing costs will yield valuable information to the industry if the results are made generally available by operating companies.

Water-Power Resources Aid Norway

The upper view shows a valley in Norway before the development of its water-power resources. The lower view shows the same valley after the site has been developed for the Rjukan station, which supplies power to the large saltpeter factory. About 100,000 hp. is utilized in Norway for making saltpeter by electrical processes. Furnaces of 4,000 kw. of the Birkeland-Eyde type are used in this factory in the city of Rjukan. These furnaces use a strong electromagnetic field to spread and draw out the arc.

Water Powers of Norway

A Realization of Its Vast Power Resources Has Brought the Scandinavian Kingdcm to the Front as an Industrial Nation—In Norway More than 5 Hp. per Capita Is Available from Hydro-Electric Developments

By C. N. ANDERSON

THE general idea of Norway is of a land full of milk and honey because of the prevalence of cheap electrical power. As the result of an extended tour of the kingdom the author of this article describes the whole Norwegian situation in a way that co-ordinates the engineering developments and their effect on industrial and social conditions. In studying costs the reader must consider the relative purchasing power of money in Norway and the United States, but the data afforded are interesting and valuable to all conservationists.

IN ACTUAL power, Norway has more hydraulic horsepower than any other country in Europe, and when one takes population or area into account it leads the world. With a maximum of 12,000,000 available horsepower distributed over less than 125,000 square miles and among a little more than 2,000,000 people, there is an average of 100 hp. per square mile and more than 5 hp. per individual. Compare this with the United States, with 6 hp. to 10 hp. per square mile and from ¼ hp. to ½ hp. per individual. Of the 12,000,000 hp., 1,650,000 is developed, leaving an enormous amount waiting for a market or for the capital to develop it. The first electrical power station in Norway was built in 1885. Today there are more than two thousand, and few buildings, urban or rural, are without electric lighting and few homes without electric stoves and cooking apparatus.

The uses to which the power is put are many and varied. One-quarter of it is used directly by sawmills, pulp, paper and grist mills. Of the remainder approximately 10 per cent is used for light, 10 per cent for heat, 60 per cent is utilized by large electrochemical, electrometallurgical and electrothermal industries and 20 per cent by railways and for miscellaneous purposes. Just what the future consumption will be is a matter of speculation. With a continued increase in population at the same rate at which it has increased in the past hundred years, it will be another century before the present population will be doubled. Allowing 1 kw. per individual at that time, 1,500,000 kw. for heating city buildings and 500,000 kw. for railways, there is still left from 2,000,000 kw. to 3,000,000 kw. for the use of the large industries.

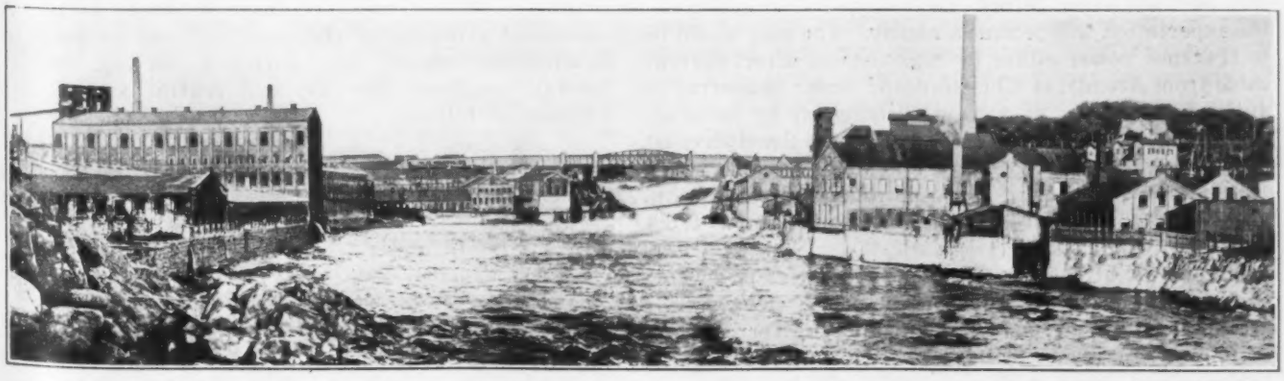
The reason for the large allotment to individual use is that a strong feeling against capitalism prevails and every means is being taken—almost to the extent of absurdity—to hinder anything but community development of Norway's greatest natural resource. "It belongs to the people and it is the people who shall reap the benefits" is the cry. Public ownership is, however, no better here than anywhere else—probably worse. Norway is not a rich country and cannot appropriate at one time enough money to carry a development through within a few years, but rather appropriates a little at a time. This means that the work is spread out over a long series of years, enthusiasm wanes, progress slackens, personnel changes and so do plans.

Moreover, some of the plant designers are addicted to extravagance when the community is to pay the bills—trying to incorporate every little whim, to include every possible piece of apparatus, so that it will be impossible for any one else to say: "We have something that you haven't." Such practices can only result in a more expensive output and a decrease in demand.

Low as the cost of energy is, a consumers' strike is not an unheard-of thing in Norway. The cost figures given below are for the year 1919 at normal rate of exchange:

	Range	Average
Horsepower-year	$15.00—$65.00	$25.00
Kilowatt-year—light and heat	35.00— 90.00	45.00
Kilowatt-hour—light	0.06— 0.20	0.08
Kilowatt-hour—power	0.025— 0.15	0.05

As these prices were under pre-war contracts and continued through the period of inflation the equivalent cost in dollars at the present time is from one-half to three-quarters of the figures given. One notable



AT SARPSFOSS 58,000 HP. IS UTILIZED BY TWO POWER STATIONS, ONE OF WHICH USES THE ENERGY TO PRODUCE CELLULOSE

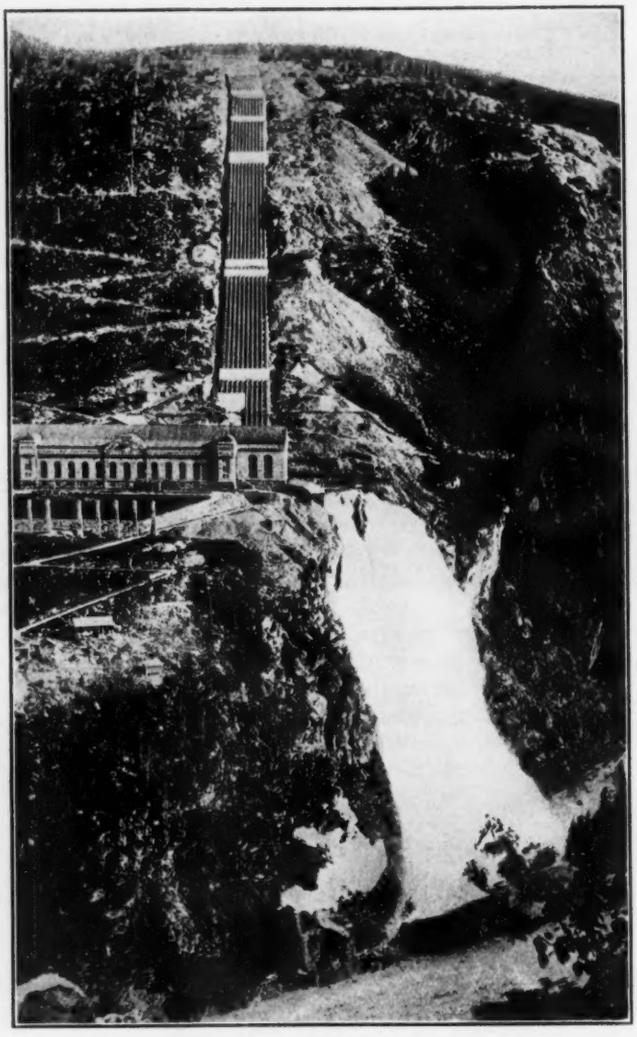
example of cheap power is the case of the city of Christiania, which buys from Kykkelsrud, under a contract not expiring before 1948, 20,000 kw. at 35 kroner ($9 normal exchange, $6 present) per kilowatt-year. At a later date 4,000 kw. additional was contracted for at five times the previous price.

In contrast with the American farmstead, practically all of the farm buildings not too far back in the mountains are supplied with electricity for light, heat and power. The farmsteads are not large, so that where the land is tillable at all the different homes are so near together that one transformer is sufficient for several farms. Voltage and frequency for the most part have wide limits, and transformer losses are not taken into account, for the reason that the energy is sold by the kilowatt-year. The common voltage is 220. Power consumption is limited to the amount to which the consumer is entitled by a time-acting relay called a "vipper," of which there are several types. This intermittently breaks the circuit when the power consumption exceeds the predetermined amount.

There has been considerable discussion about the exportation of power. Sweden is fairly well supplied, with the possible exception of the territory on the Norwegian frontier. Denmark, on the other hand, is dependent entirely on steam generation, and at present there is much discussion over the projected export of 100,000 kw. to that country. There is so much skepticism, however, arising from the conditions which are to be met, the problem of financing the undertaking and the question whether Norway can afford to contract away a hundredth part of her power that it will probably be many years before the exportation will become a reality. The plan would be to transmit power either by high-tension direct-current cable from Arendal or Christiansand under Skagerrak to Jutland, a distance of a hundred miles, or by an alternating-current transmission line along the Swedish coast to the vicinity of Gothenburg and then by cable under Kattegat to the island of Laesö and then to Fredrikshavn. Copenhagen is already supplied by power from Trollhättan, Sweden.

The power utilized by the large industries is devoted to the manufacture of carborundum at Eydehavn near Arendal; ferro-chrome, ferro-silicum, and ferro-molybdenum at Meraker, Tysse, Eydehavn and Sarpsborg; carbide and cyanamide at Odda, Björlvo, Meraker, Kragerö, Sarpsborg and Saude (under development); aluminum at Eydehavn, Christiansand and Höyanger; sodium at Fredrikstad, copper and nickel at Kopperaaen and Sulitelma, iron at Ulefoss, steel at Stavanger, saltpeter at Christiansand, Notodden and Rjukan and in other smaller cities.

Of these, the saltpeter industry is the largest, and the town of Rjukan, with its good homes and shops, parks, public library and waterworks, bountifully supplied with electricity, is an excellent example of how engineers may bring modern civilization to what a few years before was an almost inaccessible wilderness.



THE RJUKAN I STATION DEVELOPS 162,000 HP. AND SUPPLIES POWER TO SALTPETER FACTORIES

Norway can be divided more or less naturally from both a geographical and a hydraulic standpoint into two divisions—northern Norway and southern Norway. The former consists of a long narrow strip extending from the Russian frontier east of Nord Kyn and Nord Cape, the two most northerly points on the mainland of Europe, to the vicinity of Trondhjem. Here the peninsula widens out into the lobe which is usually called Sydlige Norge. This part not only has the most inhabitants but also 80 per cent of the available water power.

The mountain divide which runs approximately north and south in Norway, a little to the west of the median meridian, forms a divide for the streams. On the west side the streams are numerous and short and consequently have high heads without an exceptionally large amount of water, in spite of the fact that they are in the region of greatest rainfall. On the east side the streams are longer and heads are not so high, but there is a larger amount of water on account of the large drainage areas. A convenient grouping of the waterfalls can be made by dividing the country into northern Norway, western Norway, southern Norway, and central and eastern Norway, as follows:

Section	Hp. Available	Hp. Developed
Northern Norway	2,700,000	152,000
Western Norway	5,050,000	500,000
Southern Norway	2,180,000	622,000
Central and Eastern	2,610,000	380,000
Total	12,710,000 Hp.	1,654,000 Hp.

The available power does not include waterfalls, in which pre-war construction would cost more than $125 per turbine-horsepower, or falls which without regu-

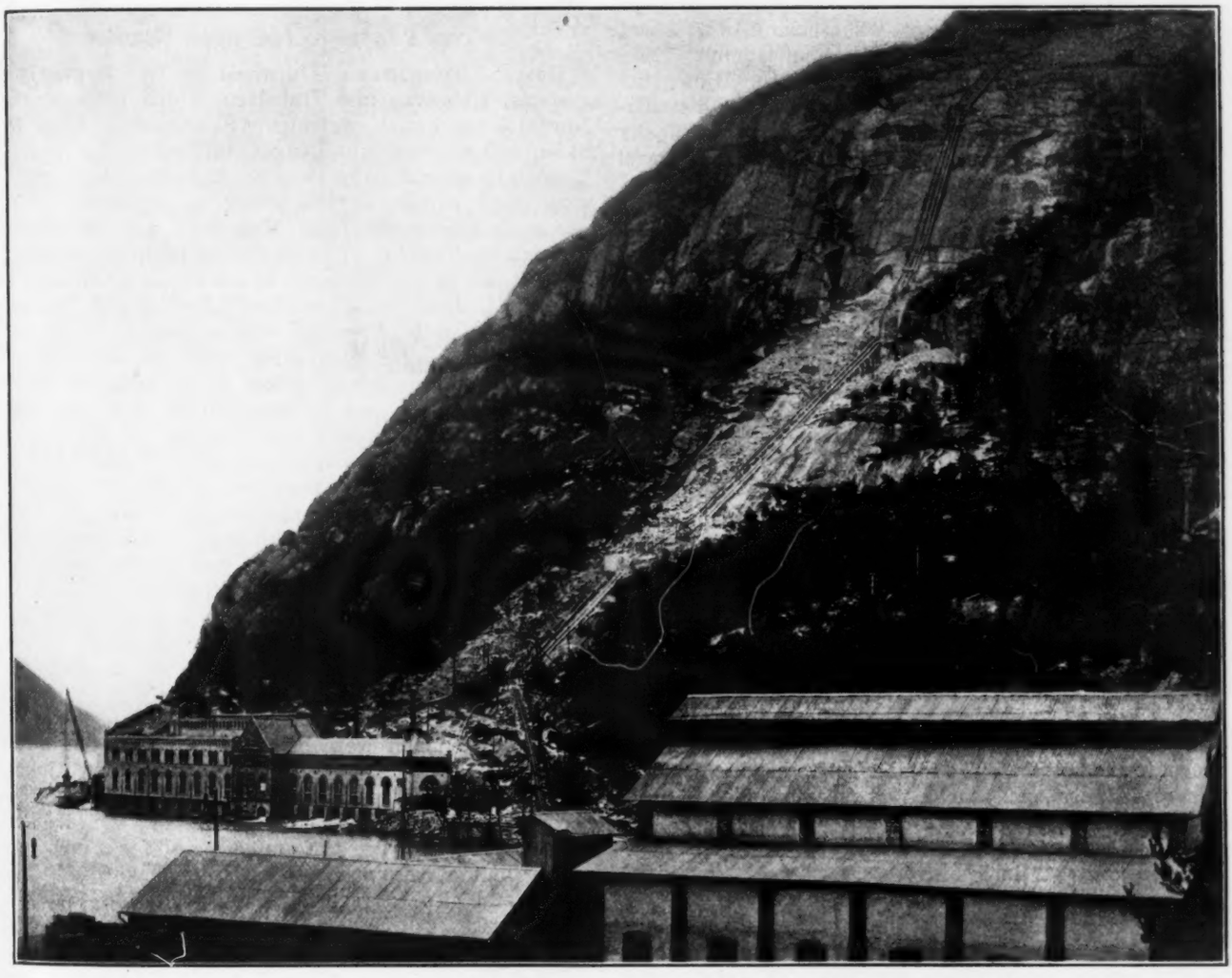
lation would give 1,000 hp. If other sites are included, the total would be increased by 20 per cent.

WATER POWERS OF NORTHERN AND WESTERN NORWAY

The water powers of the provinces of Finmark and Troms are for the most part not large but may be of great importance in supplying light and heat for the scattered inhabitants, who live by artificial light for a large part of the year. At present only a few sites are developed, one supplying Hammerfest, the most northerly city in the world, which lies 200 miles within the Arctic Circle. Another, Kaafjord, supplies power and light to an observatory where many investigations of the aurora borealis have been made.

The largest developed power site in northern Norway is on the River Fykanaaga, usually referred to as the Glomfjord development. It is situated on the Glomfjord, 30 miles south of Bodö, 20 miles north of the Arctic Circle and close to Svartisen, the only known glacier in Europe which descends right down to the sea. As there was no natural place for the power station, the river was diverted through a tunnel into the sea and the power house built directly across the old channel. As a first development there are installed two Pelton turbines of 25,000 hp. each and one of 27,500 hp. with a head of 1,450 ft. Each turbine has two runners with one nozzle for each runner. There is only one turbine bearing, the other end being coupled to the generator shaft, which is equipped with two bearings. The generators have a continuous output of 22,000 kva. at 80 per cent power factor and are operated at 25 cycles and 14,000 volts to 15,000 volts. The total available horsepower is 143,000.

Numerous sites are found along the fjords on the west coast of Norway. Of these fjords, Sognefjord is the longest and one of those most frequented by tourists. About 100 miles long, it is nowhere more than 4 miles wide, and in some places almost sheer mountain walls rise above waters 4,000 ft. deep. In the mysterious recesses of its gloomy gorges the old Norse mythology had its home, and they should be the last retreat of those trolls and gnomes by whom they were believed to be inhabited long after faith in Odin, Thor and Freya had been abandoned. In some of the deep ravines the light of the sun does not penetrate for months.

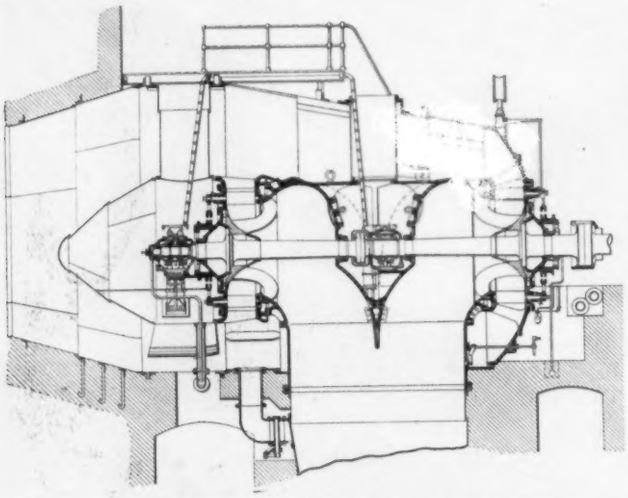


TYSSEDAL STATION DEVELOPS 142,000 HP. WITH A HEAD OF 1,277 FT. AND SUPPLIES POWER TO CARBIDE AND CYANAMID FACTORIES

Aalesund and the immediate community are supplied with light and power from the power station at Tafjord, where two generators with a capacity of 7,300 hp. each are installed. This is the only development in Norway in which the transmission is at a higher voltage than

65,000 volts. Here the transmission voltage is 150,000. The Hoyanger plant of the Norsk Aluminum Company is situated on the Hoyangerfjord, an arm of the Sognefjord. Here are installed seven 4,500-hp. generators driven by Pelton turbines. Each generator is rated at 300 volts, 10,000 amp., direct-current, and they are said to be the largest direct-current generators in the world driven by water power. The problem of regulation was a little difficult in that the generators were required to work under heads of from 1,840 ft. to 2,460 ft. and under conditions in which the load was often thrown entirely on or entirely off.

The Bjölvo power station on the Hardangerfjord is unique for several reasons. The river is very short and has a drainage area of 25 square miles only. There is a small natural regulation basin in the Bjösegrönvandet from which a tunnel leads down to the distribution basin, then through a 1,500-m. tunnel and finally through penstocks from a point 1,485 ft. above sea level



HORIZONTAL DRUM TYPES OF DOUBLE FRANCIS TURBINES ARE USED IN THE VAMMA STATION. EACH UNIT DEVELOPS 12,000 HP. AT 214 R.P.M. UNDER A 90-FT. HEAD

down to the station. The total effective head is 2,860 ft. There is only one penstock at present, 5 ft. 10 in. in diameter at the top and 2 ft. 8 in. at the bottom. The lower part of the penstock is of ½-in. steel pipes reinforced by 1½-in. x 4-in. steel bands 12 in. apart center to center. The three 12,300-hp. units are driven by Pelton turbines. The generators are three-phase, rated at 10,750 kva., 12,000 volts, 50 cycles, 375 r.p.m., with direct-connected 77-kw. exciters. This station has the high-tension apparatus mounted out of doors—one of the few such installations in Europe. No trouble has ever been experienced, although the station is in a region where it rains three hundred days out of the year and at times the apparatus is almost buried with snow.

The largest developed site on the west coast is at Tyssedal. The drainage area of the system is less than 200 square miles and is composed for the most part of a bare mountainous section at an average of 3,500 ft. above sea level. In this section lie numerous small lakes which empty into a larger lake, Ringedalsvand, 3 miles from Sörfjorden and 1,500 ft. above sea level. At the outlet of this lake there is one of the largest dams in Scandinavia, with a length of 1,700 ft. and a height up to 110 ft. The regulation basin can hold 300,000,000 cu.m. and can be regulated through 155 ft. Two tunnels, more than 2 miles in length through solid bedrock, conduct the water down to the distribution basin 1,400 ft. above the sea, from which five penstocks lead down to the station. There are installed fifteen Pelton units of various capacities aggregating 141,840 hp. In order to utilize the head between the distribution basin and the level of the drainage area it is planned to construct a second station at Ringedalsvand which will be as large as, if not larger than, the present development.

There are five sites in the Saude drainage system, not far from Stavanger, two of which are developed. American machinery is used.

WATER POWERS OF SOUTHERN NORWAY

Most of Telemarken is drained by two large river systems, Eidselven and Tinnelven, which unite in the Nordsjö, the outlet of which (Skienselven) flows by Skien and empties into Langesundfjord at Porsgrund. There are several large sites on Eidselven, but only a very small portion of the power is developed. Tinnelven is fed chiefly from Maarelven and Maanelven through the Tinnsjö. The regulating basin of Mösvand, 3,000 ft. above sea level, serves six stations—Rjukan I, Rjukan II, Aarlifoss, Svaelgfoss, Lienfoss and Tinfoss.

The Rjukan I (Vemork) station was built by the Badische Anilin & Sodafabrik, with 80 per cent of German capital, to supply power to the saltpeter works at Rjukan. It was set in operation in 1912, and with its 162,000 hp. it stands near the top of the list of world's hydro-electric power stations. It was built at a time when much of the machinery of the size required was more or less in the experimental stage. In fact, the whole station was built with more or less skepticism. For that reason we find it half way up the mountain side, and for a long time much of the power went to waste. Later Rjukan II (Saaheim) was built, 4 miles away, to develop power from the discharge water of Rjukan I. A gain of about 325 ft. is made by placing the Rjukan II station down where it is instead of at the bottom of the gorge below Rjukan I. If the development were being made today, the whole station would no doubt be placed at the site of Rjukan II and the whole head utilized by the one plant. On account of the deep and narrow valley in which Rjukan lies, one does not see the sun directly for nearly six months out of the year. In order to make conditions better and also to facilitate transportation, the saltpeter factories would probably be placed 10 miles farther down the valley, on the shore of the Tinnsjöen.

From the distribution basin nearly a thousand feet above the station eleven penstocks from 4 ft. to 6 ft. in diameter conduct the water down. Each penstock is divided to supply one turbine. These are of the double Pelton type with two nozzles for each runner. The turbine efficiencies have recently been raised from 70 to 88 per cent by a slight change in the needle and bucket design.

On account of the lack of confidence at the time of installation in the construction of a single generator of the size necessary, each generator consists of two entirely separate generators on the same shaft inclosed in the same generator housing. They have their own excitation regulation and are fed from their individual transmission lines. The three-phase unit is rated at 14,500 hp., 16,800 kva., 11,000 volts and 50 cycles.

The Saaheim station is within the limits of the town of Rjukan, about 4 miles below the Vemork

station. From the discharge canal of the latter station the water is led down to the Saaheim station by means of a tunnel blasted out of solid rock. This tunnel is a little over 100 sq.ft. in cross-section and has a possible delivery of 2,275 cu.ft. per second. It lies from 100 ft. to 200 ft. deep in the side of the mountain, sloping about 40 ft. in the four miles, ending in a distribution basin blasted out of solid rock inside the mountain. From the distribution basin there go nine penstocks laid in three separate tunnels also blasted out of bedrock. The reason for the grouping is to insure safety in case any of the penstocks should burst. The station building is well built from both the practical and the architectural standpoint. It is constructed entirely of reinforced concrete and houses the furnaces of the saltpeter factory as well as the power station. This combination was resorted to chiefly for one reason and was incidentally made advantageous from two other standpoints. The main reason was to avoid the paying of several million kroner for a new concession, the concession under which the present arrangement was built being an old one and under old laws. In carrying out the plan the transmission system was considerably simplified. The method adopted is such that the necessary cooling of gases takes place in their transport to the saltpeter factory, two-thirds of a mile distant. The gases are first passed through steam boilers which furnish power for three steam turbines and the steam used in the manufacture of saltpeter.

The generator bay in the main building houses the ten twin-runner turbine-driven Pelton units. The turbines of three of the units are equipped with directly connected oil pumps, which not only present a good appearance but take up no space to speak of and are very dependable. The generators are three-phase, operating at 9,500 volts and 18,800 kva., with directly connected exciters. The total output is 150,000 hp.

The switching is of the simplest. One divided bus makes it possible to have any one generator supply power to any furnace. This is rarely necessary, however. It is so only in case one generator unit and a furnace not corresponding to it become inoperative at the same time. For the most part, each generator supplies its corresponding furnace direct, with instrument transformers and excess-current relays on the second floor, knife switches and bus on the third floor, and knife switches on the fourth floor to the choke coils and furnaces in another part of the building. There is no automatic protection except the excess-current relays which operate circuit breakers in the excitation system.

Aarlifoss, Lienfoss, Svaelgfoss and Tinnfoss form a group of stations in the vicinity of Notodden.

The Nore Falls are about 40 miles northwest of Kongsberg and have more than 300,000 hp. available. The sites are owned and are being developed by the state. The work has been spread over several years and numerous plans have been studied. At present work is proceeding slowly with the dam and tunnels.

Vittingfoss and Hakavik are interesting stations, the former being one of the few vertical-shaft installations in Norway. The latter supplies power for the Christiania-Drammen railway, which was changed over from steam last summer.

Nearly the whole of the eastern and central section of Norway is drained by the River Glommen. It is Norway's largest river system and drains one-eighth of its area. There are four or five large undeveloped sites in upper Glommen, but interest is largely directed to the group of five large stations situated within a few miles of each other near the mouth of the river.

Raanaasfoss is 30 miles east of Christiania and has 48,000 hp. of the available 72,000 hp. developed. It is a fine example of power-house construction and is unique in several respects. Two large sector gates 165 ft. long in the middle of the 660-ft. dam are among the largest of their kind. On one end is a rolling gate 150 ft. long and 21 ft. high. The Francis turbines are of horizontal double-runner type, set in open flumes, requiring 3,500 cu.ft. per second under the 40-ft. head for a full load of 11,200 hp. at 107 r.p.m. On account of the low head and the exceptionally low speed, these turbines are unique. The generators are monstrous affairs with rotors 26 ft. in diameter. They have a capacity of 12,000 kva. at 7,500 volts and 50 cycles. Four of them are installed.

The Mörkfoss-Solbergfoss development is at present under construction, and 194,500 hp. will eventually be developed under a head of 70 ft. The dam is built directly across the river, with an auxiliary station placed directly over the old channel housing three 15,000-hp. units. The main station is to be parallel with the river channel and will contain thirteen 11,500-hp. turbine-driven units. All modern European practices are made use of in this station. There are two low-tension buses, but the plan is to operate the generator and transformer as a unit and to parallel on the high-tension side by means of two sets of buses each sectionalized for two units to which the outgoing lines are connected by oil breakers and knife switches. The transformers are equipped with Petersen coils. This station is being built by the Norwegian state and the Christiania commune.

Low-Head Stations Occur on Glommen

The Vamma power station is a fine example of a modern large low-head station and has been in operation since 1915, furnishing power to Christiania through the Kykkelsrud station and to Fredrikstad and Fredrikshald through the Hafslund station. The dam is 920 ft. long and 130 ft. high. The entrance to the fifteen penstocks is protected from floating débris by trash racks provided with electric heating to prevent the formation of ice. The two 70-ft. and 90-ft. rolling gates are also provided with electric heating. The power house is very attractive, with a plaster frieze on the wall of the generator room and air outlets attractively latticed. Seven units of from 12,000 hp. to 15,000 hp. are installed. The horizontal twin turbines are of Francis type. More than 150,000 hp. is available.

The Kykkelsrud station, with 46,000 hp. of its available 65,000 hp. developed, is situated almost within walking distance of the Vamma and Mörkfoss-Solbergfoss stations. It was built twenty years ago and so is of old design, with old machines and old switching equipment. Two Swiss turbines of obsolete design have the gate opening varied by a cylinder which, moving up and down, varies the width of the opening and also the effective width of the runner. A set of seven siphons used to keep the level of the dam constant is interesting.

Most of the power from this station is transmitted by means of cable to a very modern transformer station a few hundred feet distant, which in turn transmits the power to the city of Christiania. A telephone oper-

ated by means of carrier current over the high-tension power lines is in very satisfactory operation between this transformer station and the corresponding one at Toien, near Christiania. This is one of the earliest carrier-current installations in Norway.

One of the very first stations in Norway was built at Sarpsborg. The power available here is utilized by two other power stations—Hafslung and Borregaard. The dam is common to these two plants and the regulation is taken care of by a company that transports logs on the river. The stations are not particularly interesting except from the standpoint of noting the development made in power-house design and machinery in the past twenty-five years. Part of the power of the Borregaard station is used in three electric boilers in which the electric current flows through the water between two electrodes. Each boiler has a capacity of 2,000 kw., 4,400 lb. of steam per hour, corresponding to 2,500 tons of coal per year. The annual saving is calculated at $20,000.

The foregoing is an attempt to give an idea of the status of water powers and their development in Norway at the present time, detailed descriptions being far beyond the limits of this article. Norway has a high density of electrical power and her solution of its disposal is going to be of interest. The fine examples of hydro-electric engineering which now exist in that country and her success in bringing electric light and power within the reach of the isolated peasant are an excellent beginning, but the replacement of black coal by "white" on her railroads and merchant marine, the financing and developing of a market for her large industries and the extension of the power network to every nook and crevice in the land form no small task.

Illumination of Post Offices

Experts, After Investigation, Advocate a Standard System Throughout the Country that Will Insure 10 Foot-Candles on Working Planes

AT THE request of the postmaster-general, the Office of Industrial Hygiene of the United States Public Health Service made a survey of one old and one comparatively new post office to determine whether the prevailing illumination is sufficient, and of such character and strength as will promote the greatest efficiency of the occupants. The conclusions are now available, and were briefly reported in the Feb. 24 issue of the ELECTRICAL WORLD. They are interesting in their details not only as they bear on post office lighting but for their relevancy to illumination in general. The report says in part:

"The illumination in the post offices studied was found to be low in intensity and unsatisfactory in quality. Glare is prominent, shadows are numerous, lights are improperly spaced and improperly located in relation to work, and the intensity of illumination is irregular and unequal. The actual mean illumination in these post offices is generally below the state codes of lighting requirements and is generally lower than the mean illumination which is furnished employees doing similar work in private industries.

"There seems to be a definite relation between certain diseases of the eye and defects of the vision and the amount of illumination under which similar groups of workers were occupied. In this respect it was found that the employees at the old post office, the majority of whom were working under an average illumination of 2 to 3 foot-candles, had less than normal vision and a greater number of certain defects than the employees at the new post office, the majority of whom were working under an illumination of 3 to 4 foot-candles and a not inconsiderable number under part-time daylight.

"The higher the intensity of illumination up to a certain point, varying with the visual acuity of the eye, the more rapidly was the work performed. Those having normal or nearly normal eyes worked most rapidly under an intensity of artificial illumination of between 8 and 10 foot-candles. Those with eye defects showed less fatigue when working under higher intensities of illumination than when working under lower intensities.

"It is believed that the installation of the proper illumination would result in a large pecuniary saving to the post office, would also tend to reduce eye fatigue and defects resulting therefrom, and would conserve the eyesight of the employees.

PRESENT SYSTEM SHOULD BE CHANGED

"The present illumination in the post offices should be changed. There should be installed in the general workrooms and offices systems of totally inclosing units, of the diffusing or light-directing type, giving a general intensity when first installed of 10 foot-candles everywhere on a horizontal working plane 45 in. above the floor. All local lighting should be done away with.

"The lighting unit to be installed in the general workrooms of the post office should be of such quality of glass and of such shape and size that its surface brightness at any point would not exceed 2.5 cp. per square inch when used with an incandescent lamp or other source of light emitting 3,100 lumens. This unit should have an output of at least 80 per cent of that of the clear lamp and a spherical distribution of its candlepower such that at least 8 per cent of the light emitted by the clear lamp would be emitted by the unit through the zone from 0 deg. to 30 deg., at least 28 per cent from 0 deg. to 60 deg., at least 48 per cent from 0 deg. to 90 deg., and at least 25 per cent from 90 deg. to 180 deg.

"The lighting unit for the offices of the post office should be of such quality of glass and of such shape and size that its surface brightness at any point would not exceed 2 cp. per square inch when used with an incandescent lamp or other source of light emitting 3,100 lumens. This unit should have an output of at least 80 per cent of that of the clear lamp and a spherical distribution of its candlepower such that at least 8 per cent of the light emitted by the clear lamp would be emitted by the unit through the zone from 0 deg. to 30 deg., at least 23 per cent from 0 deg. to 60 deg., at

least 43 per cent from 0 deg. to 90 deg., and at least 35 per cent from 90 deg. to 180 deg.

"Both the units for the general workrooms and the offices should be such in number and so spaced that the brightness of the units measured in lumens per square foot would not be more than one hundred times as great as the intensity of the illumination, measured in foot-candles, produced by them on a horizontal plane 45 in. above the floor.

"In order to obtain the recommended intensity of illumination of 10 foot-candles on the working plane it would be necessary to use about 2 watts per square foot of floor area in the general workrooms of the post office. The best spacing and mounting height of these lamps and the best size of lamps to use will depend on the height of the ceiling and the height of the working plane.

"The relation of the separation cases, tables and desks to the lights should be such that no shadows fall upon the working plane. In order to accomplish this result, where it is necessary to move the lighting fixtures, detachable fixtures may be used.

"In the case of the illumination of separation cases the relation of the separation cases to the lights should be such that the centers of the units would be 1 ft. in front of the plane of the vertical face of the pigeonholes.

"Care of the lighting should be placed in the hands of one man, who should be responsible for the upkeep and care of the units. He should make a daily round of the building and replace all burnt-out lamps and broken fixtures. He should cause the lighting units to be cleaned once a week, or as often as is necessary to keep them clean. He should see that the walls and ceilings are kept in good condition, so as to serve as good reflecting surfaces for the light. He should make measurements once a month with a foot-candle meter, in order to see that the uniformity and constancy of the illumination are maintained.

All the lights of a work area should be on one switch, and this switch should be under the control of a foreman, so that one light could not be turned on to the exclusion of the others.

REQUIREMENTS OF ILLUMINATION FOR POST-OFFICE WORK

"In practically all post-office work there are two working planes, the primary plane being approximately horizontal, the secondary being vertical. Most of the eyework involves either reading or writing and thus pertains to a single surface in contrast to work requiring use of depth, such as machine work, millinery or tailoring. This is true of both vertical and horizontal planes. The height of the horizontal working plane, usually 45 in. above the floor, varies somewhat as the mail passes through the hands of the worker, while the distance of the vertical plane from the eye remains nearly the same, being the surface of the separation cases.

"There are many different colors and combinations of colors among the mail matter, although black ink on a light or white surface predominates. There are many combinations, however, which are distinctly difficult to read, handicapping the worker and straining his eyes. Such combinations are a dark background with an ink of the same color but slightly lighter shade, and colors which do not give any great contrast, such as black on blue, brown on buff, purple on violet, and red on red. The envelopes coming from central Europe are nearly all colored. To read the addresses on the foreign mail and to distinguish the marking on foreign stamps a particularly good light is required. In the money-order and registry departments the Post Office Department uses blue and red cards and blanks, which must be handled in large numbers by employees and which are difficult to read and tiring to the eyes. Frequently glossy-surfaced envelopes are used, and in recent years window envelopes, which render the reading of addresses less easy. Names and addresses are often difficult to read. This is particularly true of wrappers for newspapers and magazines, of longhand addresses and of foreign mail. These conditions require great concentration of vision.

"Some kinds of work require more light than others. For instance, clerks require more light than laborers. The 'American Standard Code of Lighting' gives 5 to 10 foot-candles as necessary for the former and 2 to 5 foot-candles for the latter. The eye work done in the post office can be for the most part classed with the eye work of other office workers and in some parts is as difficult as that for which the 'American Standard Code of Lighting' recommends 10 to 20 foot-candles and above. Since the general level of artificial illumination is rapidly rising in this country, it is impossible to say what the best illumination for post-office work will ultimately be found to be, but it is probable that it will be found to be higher than that indicated at the present time.

GENERAL LEVEL OF ILLUMINATION INCREASING

"That the general level of illumination is rapidly increasing is shown by reference to figures given in the textbooks and lighting codes published during the last ten years. For instance, Bell, in 'The Art of Illumination,' published in 1912, says: 'All classes of clerical and office work can be performed easily under an illumination of 3 to 4 foot-candles,' and in 'Light and Its Use and Misuse, a Primer of Illumination,' prepared under the direction of the Illuminating Engineering Society, published during the same year, it is stated that 'ordinary reading, writing, or work on white or light-colored material, can comfortably be carried on by most people with an illumination of 2 to 3 foot-candles.' Clewell, in 'Factory Lighting,' published in 1913, gives 3 foot-candles as a good working intensity for office lighting. In 'Principles of Interior Illumination,' 1917, Cravath, Harrison and Pierce give 3 to 7 foot-candles as desirable illumination for office work, and Croft in the same year, in 'Practical Electric Illumination,' recommended 4 foot-candles for office work. The 'Code of Lighting for Factories, Mills, and Other Work Places,' published by the United States Public Health Service in 1919, recommends 4 to 8 foot-candles for office work. In the 'American Standard Code of Lighting,' published in 1922, this recommendation is advanced to 5 to 10 foot-candles. The recommendations of the state codes of lighting, beginning with the Pennsylvania code in 1916, show that much higher standards have prevailed during the last six years, and they also show a tendency toward a still higher level. For instance, Wisconsin in 1917 recommended 3.5 to 6 foot-candles, and in 1921, 4 to 15 foot-candles, for office work. The 'Code of Lighting for School Buildings,' prepared by the Illuminating Engineering Society in 1918, recommended 3.5 to 6 foot-candles for class and study rooms, with a minimum of 3 foot-candles, whereas the 'School Lighting Code' of the State of Wisconsin for 1921 rec-

ommended 8 foot-candles and higher, with a minimum of 5 foot-candles, for the same class of work.

"The recommendations of the state codes, arranged chronologically, are given in the table.

"One cause for the increase in the intensity of illumination recommended for various eye occupations may be that the great progress made in the manufacture and design of lighting units, globes and reflectors has made it possible to have higher intensities of illumination without increased brightness of the source, so that lamps of high wattage can now be inclosed in opal or other diffusing globes without causing objectionable glare from the high brightness of the surface of the units. Almost as important as sufficient illumination is the reduction of glare. Intensity of illumination and glare may be considered as the two elements of the subject, and one is almost as fundamental as the other.

GLARE AND SURFACE BRIGHTNESS

"Glare is caused by intrusion of non-useful light on the retina of the eye. No matter how well illuminated the objects on the working plane may be, clear vision of them may be destroyed by bright images of foreign objects in the field of vision.

"Glare may be produced by bright sources of light in the field of vision, by a large source of light close to the eye, by a light lying within a small angle from the object looked at, by a light standing out against a dark background, by exposing the eye to a source of light over a long period of time, and by light reflected into the eye from polished surfaces or glossy paper.

"The elements of glare are, then: (1) The brightness of the object producing it; (2) the angle of glare, or the angle that the line joining the eye to the object being looked at makes with the line joining the eye to the object producing the glare; (3) the distance from the eye to the object producing the glare; (4) the extent of the surface of the object producing the glare; (5) the contrast of the brightness of the surface of the object producing the glare with the brightness of the surface being looked at; (6) the time of exposure of the eye to the object producing glare.

GENERAL VERSUS LOCAL LIGHTING

"A distinction must be drawn between general and local lighting. In general lighting the units are so placed as to distance apart and height above the working plane and are of such power that they give an even distribution of the required illumination, 8 foot-candles, for example, all over the working plane. Local lighting is produced by single units so placed that they produce illumination only over small areas; they are illustrated by desk lights and bracket lights over separation cases. Good practice today indicates that local lighting should never be used as a regular thing, but only temporarily in emergencies. General lighting gives a higher illumination for the same number of watts used and is therefore more economical. This is due to the fact that a small number of high-wattage lamps are used rather than a large number of low-wattage lamps. High-wattage lamps produce more light per watt than low-wattage lamps.

"Since a marked increase in speed and accuracy in the work of the post office was found when the illumination was raised to 8 foot-candles, it was deemed desirable to calculate the decrease in the cost of labor and the increase in the cost of lighting and to balance one against the other to find out if any pecuniary saving would be effected by increasing the intensity of lighting in the office at which the survey was made, and if so what this would amount to.

"The actual power consumed in this post office for lighting during the calendar year 1921 was 1,113,320 kw.-hr. The cost of this power, based upon the minimum rate per kilowatt-hour under the contract with the lighting company, was, for the calendar year 1921, $26,334. The cost of replacing lamps under the present system during the year was $6,587, which makes a total cost of $32,921.

"With the above-mentioned consumption the mean illumination in this post office was 3.6 foot-candles. To find out what the consumption of power would be if this illumination were raised to 10 foot-candles, the present consumption must be multiplied by the factor 2.25. This factor is less than that required to multiply the present illumination of 3.6 foot-candles in order to obtain 10 foot-candles, because the total number of outlets is supposed to remain the same, while the illumination from a lamp increases more rapidly than does its wattage.

"The increased wattage required on this basis would bring the consumption to 2,438,080 kw.-hr., at a cost of $57,670, and the cost of replacing lamps to $14,820,

ILLUMINATION FOR OFFICE WORK RECOMMENDED IN THE STATE CODES OF LIGHTING

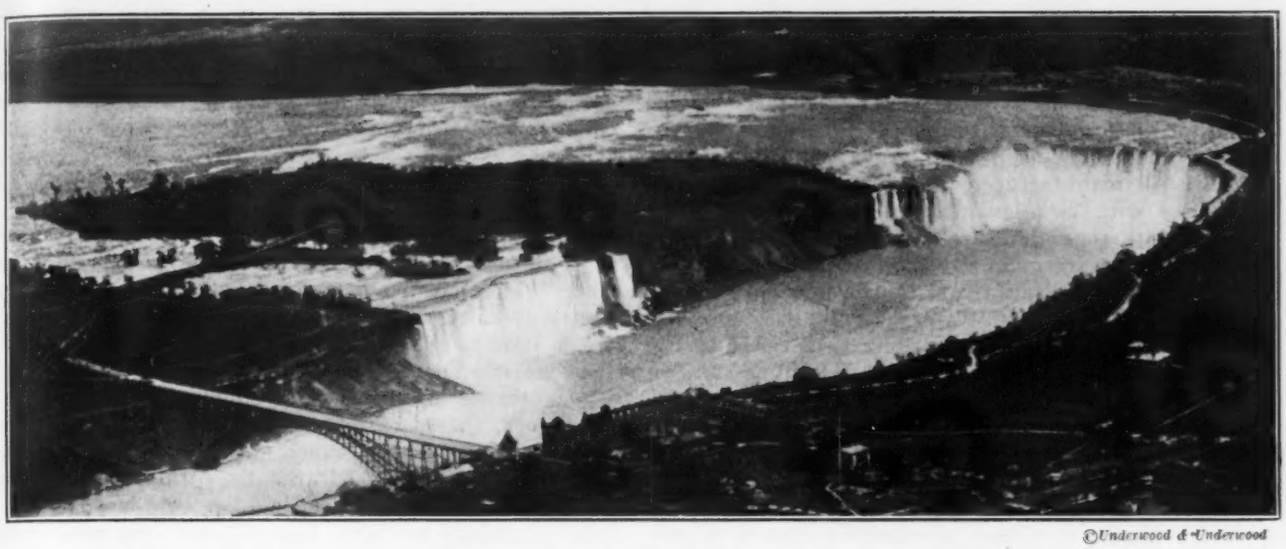
Year and State	Intensities in Foot-Candles—Good Practice	Minimum
1916—Pennsylvania	4.0- 8.0	3.0
1917—Wisconsin	3.5- 6.0	2.75
1918—New Jersey	4.0- 8.0	3.0
1919—California	4.0-12.0	..
1919—Oregon	4.0- 8.0	3.0
1920—Ohio	4.0-12.0	3.0
1921—Wisconsin	4.0-15.0	3.0
1922—Massachusetts	...	3.0

a total annual cost of $72,490. The increase in the cost for the higher intensity of illumination is therefore the difference between $72,490 and the present cost of $32,921, or about $39,500.

"The total pay roll for this post office for 1921 amounted to $6,746,039. Since investigation shows that only about one-half of the time of the workers is spent under artificial illumination, about one-half of this amount, or about $3,373,000, will represent the amount paid when working under artificial illumination.

"In the speed and accuracy tests it was found that for the letter separators there was an average increase in speed, or decrease in the times of separation, of at least 4.4 per cent when going from 3.6 to 8 foot-candles. Since all the work in the post office, with the exception of that done by the laborers, depends primarily upon the use of the eyes, and since in the post office for which these calculations are being made the laborers constitute less than 6 per cent of all the regular employees, it may be assumed that the same relative increase of speed would prevail in all the divisions of the post office under the same relative increase in illumination. If, then, 4.4 per cent is taken as the value of the percentage change in speed due to an increase of the illumination from 3.6 to 8 foot-candles, to find the pecuniary gain 4.4 per cent of $3,373,000 must be taken, which gives about $148,400.

"Deducting from this saving of $148,400 the increase in cost of energy and lamps, about $39,500, we get a net saving for this post office of about $109,000, or more than twice the increased cost of illumination."



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GOVERNOR SMITH IN HIS MESSAGE CONTENDED THAT THE WATER POWER OF THE MIGHTY NIAGARA SHOULD NOT BE PUT TO USE OUTSIDE OF NEW YORK STATE

New York State's Water Power

Reasons Why It Must Not Be Isolated or Developed Individually—Advantages of Interstate Transmission and Superpower Systems Which Embrace Steam-Driven as Well as Water-Power Stations

By GEN. GUY E. TRIPP

Chairman Westinghouse Electric & Manufacturing Company

ONE of the most important things that can be done today to insure the increased prosperity of a people is to place within their reach a cheap, abundant and reliable supply of electric power. Both the Governor of New York and the Governor of Pennsylvania recognize this fact, and both have recently taken active steps to provide their respective states with such a supply from water power. But they are advocating diametrically opposite methods for accomplishing the desired result.

Governor Smith of New York wishes to develop New York's water powers for the exclusive benefit of New Yorkers and declares that any plan to divert this energy to territory outside of the state "must be resisted with all the power we can bring to our command."

Governor Pinchot of Pennsylvania, on the other hand, wishes to bring about a unified national development of water power, and it is clear that he even includes Canada in his plans.

Which is right? At first sight, Governor Smith's plan of reserving the resources of the state for the use of the state is quite likely to appeal much more strongly to New Yorkers than Governor Pinchot's; nevertheless, in spite of Governor Smith's undoubted desire to serve the state in the most effective manner, a very serious fallacy is involved in his recommendations.

Suppose Governor Smith, with the best intentions in the world, had advocated a plan for devoting New York's railroads solely for the service of New Yorkers and had proposed that all railroad connections with other states should be broken. Such a plan would be instantly greeted with indignant protest. Every one would realize that it would destroy our splendid interstate railway systems and, without conferring the slightest advantage upon New York, would be disastrous to the nation as a whole.

No less disastrous to both New York and the United States would be the isolation of New York's splendid water powers. Why this is true should become clear when certain facts about water power are understood.

CONDITIONS OF WATER-POWER DEVELOPMENT

In the first place, few water powers are of much value if developed individually. The upper waters of the Hudson, for example, can generate over 500,000 hp. for the greater part of the year, but in dry seasons the flow (as shown by the last report of the New York Water Power Commission) may not be sufficient for the generation of 5,000 hp. Similar conditions apply to all other rivers in this part of the world, excepting only the Niagara and the St. Lawrence, which have an approximately uniform flow because they are fed from the enormous reservoirs of the Great Lakes. Consequently, in order to make power available all the year around, steam plants are almost always operated in conjunction with hydro-electric plants.

Second, electricity can be produced from two or more neighboring water powers more cheaply if the water-power plants are joined together in a single system and supplemented by a single large steam plant than if each water power is developed separately and is supplemented by a small steam plant. In the unified system the variations in the flow of the rivers tend to equalize each other, since no two rivers are at the lowest point

at exactly the same time, and less power from steam is needed; the large steam plant consumes less coal than the small plants to produce a given amount of power; the overhead expense is less, and there is less variation in the demand for power because of the increased diversity of use by the larger number of people served. All manufacturers understand that costs are much less with large-quantity production at a fairly uniform rate than they are with production in small quantities at an irregular rate. This condition is especially true in the manufacture of power.

Finally, when several water powers are interconnected, a considerable area of country is inclosed by the connecting transmission lines. By installing suitable service lines electric service can easily be given to the whole area thus inclosed. With the water powers developed separately, however, the energy from each is inevitably sent to the nearest congested district, and the regions not actually traversed by the transmission lines are unable to obtain electricity except at a prohibitive distribution cost.

IDEAL SYSTEM FOR NORTHEASTERN STATES

Since the larger the system the cheaper it can produce power and the more people it can economically serve, the ideal system for the northeastern part of the United States is one that would extend from Maine to Ohio and from Canada to Maryland and would receive the energy of every water power in the area covered. With such a system, all of the now wasted water power in this district would be put to useful work, and though supplementary steam plants would still be necessary, they would be called upon for the minimum amount of power and, since they would be of the largest and most efficient type, they would consume fuel with the highest obtainable economy. Furthermore, they would be established in the coal regions and at points of convenient access along the coast, so that a large part of the railroad facilities now devoted for hauling coal would be released for other purposes. Both the power supplied by the water powers and the demand for electricity by the communities served would, of course, vary constantly, but the great network of transmission lines would act as an equalizing reservoir and would make up deficiencies at one point from surpluses at others.

WHAT NEW YORK WILL LOSE IF SHE ISOLATES HER WATER POWER

If New York's water powers form an integral part of this great system, all of her people will be able to obtain electricity at the lowest possible cost; but if that state is determined to isolate herself electrically, she will prevent the creation of the system and will not only injure her own citizens but everybody else in this section of the country. She will not be able to use all of her water power for a long time to come, and she will therefore allow the excess to waste instead of developing it for the benefit of other states that need it badly. If, through a prolonged drought, fuel shortage or other causes, she experiences a temporary power famine, she will not be able to draw on the surpluses that may exist in other states. Since her water-power development will be incomplete, her transmission network will also be incomplete, and many of her citizens will be unable to get power.

Under the plan of state monopolization the chief sale of power will be to existing municipalities. These will tend to become more and more congested, and living conditions, especially in New York City, will grow worse and worse. But with power properly and widely distributed the population will tend to spread out into the more open country, and thus the deplorable tendency toward overpopulation of our cities may be checked.

INTERSTATE SYSTEM MAKES MORE POWER AVAILABLE

While an interstate power system takes power out of a state, it in equal degree brings power into the state. The most important of all water powers in northeastern America are not in New York at all. They are in Canada and on the Canadian boundary. If New York isolates her own power, she could not consistently ask another commonwealth to supply her with power. New York, therefore, would thus cut herself off from this vast power supply which she and her neighboring states are certain to need urgently within a generation or two.

In a strictly technical sense, New York may have the legal and moral right to monopolize her water powers. If so, the coal-producing states have an equal right to monopolize their coal for the benefit of their citizens. If New York were to be deprived of coal or of power generated by coal in the Pennsylvania coal fields, she would be badly off and would violently denounce such action as anti-social and anti-American. Yet her administration proposes to pursue a precisely similar course with reference to water power.

Finally, if New York does devote all her water power to her own use, she will not be able to produce it as cheaply as she could by co-operating with her neighbors, because she will sacrifice the advantages of large-quantity production; she will not be able to secure the full benefits arising from the co-ordination of water powers and steam plants, and she will not be able to obtain power generated in the Pennsylvania coal fields.

AN INTERCONNECTED SYSTEM PRODUCES CHEAPER AND MORE RELIABLE POWER

"After eighteen years of study and work on this problem," writes Governor Pinchot to Governor Smith, "I have come confidently to expect the growth of a nation-wide interlocking power system. . . . The freedom of commerce among the several states, the unrestricted exchange across state lines of service, goods and resources, guaranteed by the Federal Constitution, is the strongest man-made basis of the prosperity of each state. This consideration applies not only to energy riding in a coal car but equally to energy flowing over a wire, whether the burning of fuel or the falling of water was the source. Furthermore, really cheap power cannot be supplied to consumers unless the burning of coal and the flowing of water contribute their energy to a common reservoir for the common supply of industries, farms, homes and railroads. Such a system must transcend state lines and is likely to become nation-wide."

Thus are the views of a statesman in agreement with conclusions of the engineer. Back of both lie but one desire—to bring to the people of the United States and Canada the greatest possible prosperity. Neither state politics nor private interest must interfere with the proper development of our water power. The water of our rivers is a resource of the nation; it must be utilized so as to benefit the nation as a whole, and it will thus best benefit each state and each individual citizen.

Indiana Company Changes to 60 Cycles

Indiana Service Corporation Shifts Both Railway and Commercial Service—Customers' Motors Changed on Second-Hand-Price Allowance Basis—Old Rotary Converters Altered for Use

SERVICE at 25 cycles to commercial consumers exists to a considerable extent in Indiana and Ohio. Its history began with the development of the interurban electric railways in those states, when 25-cycle rotary equipment was considered as the only kind that could be successfully used. The commercial service was developed along the railway lines where the establishment of 60-cycle service seemed economically impossible. With the development of 60-cycle railway equipment and the existing tendency which makes 25-cycle equipment special and higher in cost, the problem of changing to 60-cycle service everywhere is becoming a pressing one.

Problem Facing Indiana Service Corporation

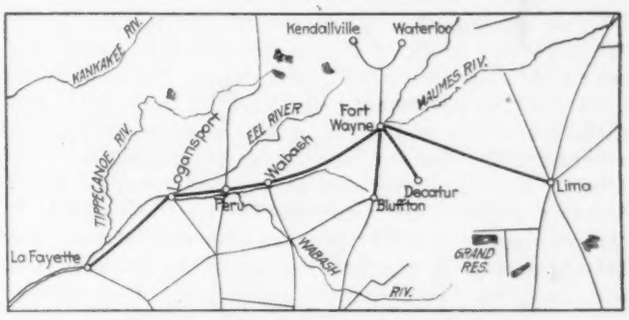
Until two years ago the west side of Fort Wayne was served from 25-cycle circuits. The interurban system of the Indiana Service Corporation centering at Fort Wayne comprises four lines, one to Lima, Ohio, one to Decatur, one to Bluffton and one to Lafayette, the three last named all in Indiana. The line to Decatur has always been served at 60 cycles, the Fort Wayne steam electric plant having been originally built with both 25-cycle and 60-cycle generators. The other three lines have been served at 25 cycles, and in addition to the railway service commercial service at 25 cycles developed on the Lafayette division in thirteen towns and some small scattering points and in five towns on the Bluffton division.

The present 25-cycle equipment in the Fort Wayne plant consists of two 1,500-kw. turbo-generators, and the 25-cycle territory has been served with 33-kv., three-phase delta-connected lines with No. 2 A. W. G. copper conductors. In addition to the service outlined power is supplied to the Fort Wayne & Northwestern Railway, running north of Fort Wayne, and to the Union Traction Company and Winona Interurban Railway electric lines through a connection at Peru, Ind. All three of these lines belong to other companies.

The important problems presented when it was decided to change all service to 60 cycles were: (1) On what basis should the motor equipment of commercial consumers, including motors in household service, be changed? (2) How could the railway equipment be changed with the least expense? and (3) What change, if any, would have to be made in transmission and distribution line equipment.

Customer's Equipment Problem

Although the changes were decided on several years ago and the service on the west side of Fort Wayne and on the Bluffton division has been changed, it was obviously impossible to make a simultaneous change over the entire system. The changes on the Lafayette and Lima divisions are now under way. One community is taken at a time, and a thorough survey of the customer's equipment is made to determine the exact size, type and number of motors that must be changed. The second-hand value of the customers' motors is then ascertained and a standard offer made to each customer. For all motors over 1 hp. in size the consumer is asked to pay the difference between the second-hand value of the equipment and the price of the new 60-cycle equipment. In all cases of fractional-horsepower motors, such as those on washing machines and other household equipment, the company traded the new equipment for the old on an even basis. In all cases the offer has specified that the cost of installing the new and removing the old equipment shall be assumed by the company. It is interesting to note that so far almost no trouble has been met. Only three or four controversies have arisen, and these have not been serious. The existing condition in the manufacture of 25-cycle equipment, which places it on a non-standard basis and therefore makes it more expensive and difficult to obtain, is one of the arguments used in convincing consumers that the change is of benefit to them. Moreover, the opportunity



SYSTEM OF THE INDIANA SERVICE CORPORATION WHICH IS BEING MADE ALL 60-CYCLE

The railway lines except that to Decatur were constructed for 25-cycle service. Along the 25-cycle lines commercial service had grown up. The west side of Fort Wayne also originally had 25-cycle service. This service and that of the Bluffton division have been changed. Similar changes are now under way on the Lafayette and Lima divisions.

afforded to improve the efficiency of old installations by the installation of equipment better suited to the work has played a part in bringing about acceptance of the proposal. It is believed that a frank, clear-cut statement of the reasons for the change, with patience and tact in telling the story, is the chief factor in persuading customers.

In making the actual change to 60-cycle service in any town all customers' equipment needing change is gone over thoroughly and complete plans for the replacement of each motor are made. These are carried out so far that the only work to be done at the final change-over is the shifting of motors. Foundations and foundation bolts for the new motor are placed and the pulleys needed to obtain the proper speeds are on hand with the new motors, which are set close to the old equipment ready for the shift. At the time of the actual change-over the important motors are changed overnight so that industrial concerns are not hampered by shutdowns. The old starting compensators are utilized throughout, and so far no trouble has been experienced. A change in compensators in most cases would

have meant the added cost of compensators plus a much greater expense in rewiring, as disturbance of old wiring involves compliance with wiring ordinances that might reach far. The sizes of motors changed range up to 250 hp., though the largest number are small, 10-hp. and 15-hp. sizes predominating. The customers are fully warned of the change and the time at which it is to be made by newspaper, motion-picture and such other advertising means as are available. The customers with household appliances are warned that the changes will be made on certain days and are asked to arrange household work so that the motor equipment need not be used on those days. Approximately three or four days is needed for these changes.

The meter problem is handled by the installation of new meters. The old meters in most cases have been changed for 60-cycle use by the replacement of current and potential coils, though some of the older types could not be handled thus and had to be scrapped or traded to the manufacturers.

Distribution transformers required no shift at all, and there were no changes in either the service or transmission lines required. Naturally, some difficulties with special equipment were encountered, though no serious troubles developed. In one case it was necessary to replace the impellers in direct-driven centrifugal pumps at a water pumping station because the motor speed could not be matched closely enough in 60-cycle equipment. A number of merchandise establishments are equipped with coffee grinders, meat choppers and other like machines in which the motors are built into the equipment. By working with the manufacturers of the equipment it was possible to promote arrangements whereby new motor equipment was supplied by negotiation between the customer and the manufacturer without any participation by the central-station company. Another problem was that of the small battery charging rectifiers employed in garage work which use the two-element vacuum tube. Material was ordered to change these over. On one man's insistence that he could do no more than burn one up, a trial showed that the chargers apparently needed no changing, and they are now operating on 60 cycles without any modification and no indication of trouble.

THE RAILWAY PROBLEM

Obviously the rotary-converter equipment was unusable. These machines and their transformer equipment varied in size between 200 kw. and 450 kw. When the question whether the transformers could be used for the new rotary equipment was raised the various manufacturers said that it would be impossible to do so satisfactorily. The old rotaries were 25-cycle three-phase, with 33,000/370-volt step-down transformers. The new equipment is all 60-cycle, 500-kw., six-phase, requiring a transformer secondary voltage of approximately 445. The old transformers were partly of the shell and partly of the core type. After some experimenting it was found that one of the middle primary coils in the shell-type transformers could be cut out of circuit and left dead. This gave the proper ratio, maintained the balance of stresses due to magnetic forces and left the transformers with the four 2½ per cent voltage regulation taps intact.

The same procedure was adopted with the core-type transformers, except that they were dismantled and an equal amount of primary winding was removed from each core leg. When reassembled wood spacing blocks were fitted in the space of the removed coils. Part of the transformers are of the type with external reactance and part have reactance built into the transformers. With the changes it was found that the reactances are approximately the same as would be supplied in new transformers to match the new rotaries. Though the windings are being operated at a higher voltage per turn than they were designed for, it has so far been impossible to discover any bad effects from the practice.

Of course, the transformers did not match the new rotary equipment as to capacities. This was disregarded as each substation has ample transformer equipment to handle present loads. When load developments necessitate or depreciation and other causes eliminate the old transformers, new equipment to match the rotaries will be purchased. Since new rotaries had to be purchased and one size could be adopted as a standard, it is felt that the operating and maintenance advantages of such standardization justified the course adopted and that economic and operating conditions could be safely left to care for the transformer situation in the future. As a matter of fact, the discrepancy in rotary and transformer capacities is not so wide as it would seem, since the transformers are designed on the old basis of rating and the rotaries are rated on the basis of present standards.

FREQUENCY CHANGERS WOULD NOT SAVE EXPENSE

In considering the various methods of establishing 60-cycle service the obvious one of handling the railway circuits through frequency changers was investigated. The result showed that the costs of this method and of the one adopted were about equal, with the disadvantage against the frequency-changer method of loss of efficiency in conversion and an expensive change later as the old 25-cycle equipment reached its life limit.

In making the changes town by town the method on the Lafayette division is typical. An interconnection for 60-cycle service with another company exists at Lafayette, making it possible by opening the line disconnecting switches installed at each substation to operate one section of the transmission line at 60 cycles and the other at 25 cycles. A 500-kw. portable substation is used to handle the service at any substation temporarily while the new rotary and its control panel, which is purchased as a part of the new rotary equipment, is installed ready to cut into service. The portable substation is then moved to the next location.

In several instances service in small communities had been supplied at 2,300 volts through step-up transformers connected to the 370-volt rotary circuits. In these cases 33-kv. step-down lighting transformers are being installed. However, this has no bearing on the change to 60-cycle service. These things are merely incidents of by-gone practice which it is possible to change and put on a better basis.

In handling the railway signal systems the only changes found necessary were the substitution of new magnet coils for the old. Some question was raised as to whether more transmission insulator trouble would be experienced on the 60-cycle service. Just why the question should be raised is not understood, but there are no indications of such a result.

The service to the interconnected railway lines is being handled in the case of the Fort Wayne Northwestern Railway by a change to 60-cycle service along exactly the same lines by that company. In the handling of the changes for commercial service the details are

being worked out by the same man who is handling the changes on the Indiana Service Corporation system, where these dealings with consumers were all placed in the hands of one man with the necessary qualifications of technical knowledge, tact and patience. The question of handling the railway interconnection at Peru is not settled as it has not yet been reached.

One experience that has been satisfactory is the ability to dispose of the old motors. Other 25-cycle systems in the territory are expanding their commercial service, and the demand, particularly for the small sizes, has been good. Larger sizes have proved harder to sell, though so far, by success in selling the motors taken out, the expense of the changes has been kept to the cost of shifting equipment. In all there are about three thousand consumers involved in addition to the electric railway service, and the progress of the work so far done has been most gratifying.

Major Changes in National Electrical Code

Covering of Overhead Conductors and Separation of Meters Dropped—Solid Neutrals, 15-Amp. Fuses and Twelve Outlets per Circuit Allowed—Proximity of Radio and Power Circuits Included—Changes in Motor-Circuit Protection

THE outcome of the final action of the electrical committee of the National Fire Protection Association on the proposed revisions of the National Electrical Code has been made available to the ELECTRICAL WORLD, in so far as the major changes are concerned, through the courtesy of Dana Pierce, chairman of the committee and vice-president of the Underwriters' Laboratories. The decisions were based on very careful considerations of written and oral discussions of the proposed changes received prior to and including the day of the public hearing in New York, namely, March 12. Owing to the fact that numerous changes in phraseology as well as actual requirements were made and because the entire code will be rearranged and reclassified, it is doubtful how soon printed copies of it will be available. However, the committee believes that the rearrangement of the code will greatly facilitate its use as a reference book and hence will justify the change.

SOLID NEUTRALS BY PERMISSION

As reported last week in the ELECTRICAL WORLD, solid neutrals or ground circuits will be permitted on two-wire and three-wire branch circuits by permission of the inspection department.

That is, omission of the fuses in these conductors will be allowed by permission. Permission is required to assure that the system to which the branch circuit is attached is properly grounded and that an identified grounded conductor is carried throughout the installation.

The omission of the fuse in the grounded side of branch circuits, it is considered by the committee, should be a part of a more general method of wiring which includes also the grounding of secondary circuits in a thoroughly reliable and permanent manner and use in installations of an identified grounded wire throughout the building properly connected to all fittings. Proper grounding of circuits and the polarization of wiring is not universal by any means yet, and it is felt that the omission of the fuse in the neutral should, therefore, be allowed at present only in places where the inspection department has determined that the grounding and polarization is provided. It is expected that such permission will be given by inspection departments for systems, cities and parts of cities where this program is known to have been actually carried out, rather than by a separate ruling on new buildings in every case.

15-AMP. FUSES FOR 125-VOLT CIRCUITS

Instead of placing a maximum limit of 10 amp. on 125-volt branch-circuit fuses, the code now allows 15 amp. for ordinary branch circuits and 40 amp. for circuits designed for "Mogul" sockets. The old limitation of 660 watts per branch circuit has been abolished. Not more than twelve outlets are now allowed on two-wire branch and each side of three-wire circulits except by special permission. Also, eight "Mogul" sockets may be connected per branch circuit if fused for 40 amp. In this case the sockets, receptacles and fixtures shall be wired with conductors not smaller than No. 12, and the taps from branch circuit wires to the point of suspension of the outlets, receptacles or fixtures shall not exceed 18 in. Where heating appliances requiring 660 watts or less are to be used they may be connected to ordinary branch circuits, but if more than 660 watts is required special circuits must be installed and the fuses shall not exceed 15 amp. rating.

DELETE METER SEPARATION AND OVERHEAD-WIRE COVERING

To electric service companies the dropping of the proposed ruling on separation of gas and electric meters and the proposed requirement of a protective covering for overhead circuits operating at voltages up to 5,000 will no doubt be a great relief.

In view of the extensive discussion on the proposed requirement that outlet boxes be at least 1½ in. deep, the committee revised the ruling to the effect that it is recommended that side-wall and partition outlets in concealed new-building work now under construction be provided with a depth approximating 1½ in. This space is considered essential to accomodate splices.

CHANGES IN MOTOR-CIRCUIT PROTECTION

Protection of motor circuits underwent considerable revision. For example, motors may be grouped on one set of fuses if the demand on the circuit does not exceed 15 amp. or 1,200 watts. Fuses are no longer required in addition to circuit breakers on switchboards, or where subject to competent supervision, or where next back on the line there is protective apparatus set

Some of the Important 1923 Amendments to the National Electrical Code

Rule 8c. Motors. *Amend to read*:

Motors may be grouped under the protection of a single set of fuses provided the rated capacity of the fuses does not exceed 15 amp. and the total wattage of the circuit does not exceed 1,200, or provided each motor is protected by thermal cut-outs. The number and size of the motors grouped with thermal cut-out protection need be limited only by the maximum size of the fuses with which the thermal cut-outs can be safely used, and each thermal cut-out must be marked to indicate the size of this fuse.

Fuses are not required in addition to circuit breakers (a) on main switchboards, (b) where otherwise subject to competent supervision, or (c) where next back on the line there are fuses rated or a circuit breaker set at not over 300 per cent of the motor nameplate rating, (d) for circuits above the capacity for which there are no standard fuses.

Where the motor-running protective device is shunted during the starting period the motor and the portions of the motor branch circuit between the motor and its running protective device are considered as being sufficiently protected during the starting period by the next overload protective device back on the line if the rating of this fuse or the setting of this circuit breaker is not over 300 per cent of the motor nameplate current rating.

SIZE AND PROTECTION OF CONDUCTORS OF MOTOR CIRCUITS

Conductors carrying the current of only one motor must have a carrying capacity of at least 110 per cent of the nameplate current rating of the motor, the actual size to be determined by the rating of the fuses or the setting of the circuit breaker protecting them.

Automatic overload protective devices may be omitted at the point where conductors carrying the current of only one motor are connected to the mains, provided their current-carrying capacity is at least one-third that of the mains, the length of the conductors between the mains and the motor protective devices is not greater than 15 ft. and they are suitably protected from mechanical injury.

Rule 8f. Motor Switches. *Amend to read:*

In places where combustible dust is thrown into suspension in the air in sufficient quantity to produce explosive mixtures, such as in flour mills, grain elevators, etc., or where it is impracticable to prevent dust or flying material collecting in dangerous quantities on or in motors, all motors shall be either of the totally inclosed type or shall be placed in separate dust-tight rooms or non-combustible housings. Such rooms or housings shall be effectively ventilated from a source of clean air.

Rule 15Aj. Method of Grounding When Protective Grounding Is Required. *Amend to read*:

Where the secondary system is grounded at the service, the equipment, metal raceway and the like may, with permission of the inspection department, be connected to the circuit grounding conductor but otherwise shall have a separate grounding conductor.

Rule 15 Am. Switchboard Instruments. *Add new section to read*:

Where meters and instruments are used with current and potential transformers, the cases of the meters and instruments may be connected to the secondary circuits of the current and potential transformers and grounded for the purpose of avoiding errors due to electrostatic action, in which case No. 12 B. & S. gage copper wire or larger shall be used for the grounding conductor.

Rule 23d. Fuses for Branch Circuits. *Amend to read*:

For the purpose of this section the terms "branch circuits" and "outlets" are defined as follows:

"Branch circuit" is that portion of a wiring system extending beyond the final set of fuses or circuit breakers protecting it, and at points on which current is taken to supply fixtures, lamps, heaters, motors and current-consuming devices generally; such points are designated as "outlets."

By special permission of the inspection department, two-wire branch circuits from systems having grounded neutral or one side grounded, and where the grounded conductor is identified and properly connected, may be protected by a fuse in the ungrounded wire, no fuse being placed in the grounded wire. Otherwise two-wire branch circuits shall be protected by a fuse in each wire.

Three-wire branch circuits may be run from direct-current or single-phase alternating-current systems having a grounded neutral, in which case the neutrals of the branch circuits shall not be fused. The neutrals of such circuits shall not be interconnected except at the center of distribution.

Branch circuits in general, and except as described below, shall be protected by fuses of no greater rated capacity than: 15 amp. at 125 volts or less, 10 amp. at 126 to 250 volts.

Fixture wire or flexible cord of No. 18 or No. 16 gage shall be considered as properly protected by 15-amp. fuses. Receptacles for attachment plugs (convenience outlets) are strongly recommended in order to facilitate the use of electrical appliances, which otherwise must be connected to sockets designed primarily only as lamp holders.

On a two-wire branch circuit and on either side of a three-wire branch circuit the number of outlets shall not exceed twelve except by special permission.

Branch circuits supplying only sockets or receptacles of the "Mogul" type shall have the wires protected by fuses having a rated capacity not greater than: 40 amp. at 125 volts or less, 20 amp. at 126 to 250 volts.

The number of "Mogul" sockets on a two-wire branch circuit and on either side of a three-wire branch circuit shall not exceed eight except by special permission.

Mogul sockets and receptacles and the fixtures with which they are used, shall be wired with conductors of not less than No. 12 B. & S. gage. Taps from circuit wires to the points of suspension of such sockets, receptacles and fixtures shall not be over 18 in. in length in order to be considered protected by fuses specified above.

Rule 26a. Wires. *Substitute for the first paragraph*:

For the conductor sizes No. 8 and smaller the neutral conductor on all three-wire circuits and one conductor on all two-wire circuits shall have continuous identifying marker readily distinguishing it from the other conductors.

Rule 28. Interior Conduits. *b. Amend to read*:

Concealed extensions from existing branch circuit outlets in buildings of fireproof construction, may be made by means of approved flexible or rigid conduit, not smaller than ⅜ in., or other forms of metal raceways approved for the purpose, and fittings containing one No. 14 B. & S. gage rubber-covered wire. This conduit is not to run in concealed spaces but is to be laid on the face of the fireproofing and may be plastered over. Extensions of this kind shall be confined to the room or suite in which they originate.

Rule 43. Electric Cranes. *c. Switches and Cut-outs. 3. Amend to read*:

Where there is more than one motor on a crane, each motor with its leads must be separately protected by an automatic cut-out in accordance with No. 8c, except that where two motors operate a single hoist, carriage, truck or bridge and are controlled as a unit by one controller, the pair of motors with their leads may be protected by a single automatic cut-out. The cut-out should be located in the cab when there is one.

Rule 47. Primary Wires. *Amend to read*:

b. Air-break disconnectors shall be installed between oil switches which are used as service switches and the supply wires.

Rule 86a. Radio Equipment. For Receiving Stations Only. *Amend to read*:

Antennas outside of buildings shall be kept well away from all electric light and power wires for any circuit of more than 600 volts and from railway, trolley or feeder wires so as to avoid the possibility of contact between the antennas and such wires under accidental conditions.

Antennas where placed in proximity to electric light and power wires of less than 600 volts shall be constructed and installed in strong and durable manner and shall be located and provided with suitable clearances so as to prevent accidental contact with such wires by sagging.

at not more than 300 per cent of the motor nameplate rating. The actual size of motor-circuit conductors shall be determined by the setting of the protective apparatus. In places where combustible dust is thrown into suspension in sufficient quantity to produce explosive mixtures, totally inclosed motors shall hereafter be required or the motors shall be set in dust-tight housings. Another important change is that automatic overload protection may be omitted at the point where conductors carrying the current of only one motor are connected to the mains, provided the motor circuit has a carrying capacity at least one-third of the mains and provided the length of the conductors between the tap-in point and the motor productive device is not greater than 15 ft.

PROXIMITY OF RADIO AND POWER CIRCUITS

So far as the relation between radio antennas and power circuits is concerned, the requirement now is that antennas shall be kept away from lines energized at 600 volts and over. Below this voltage ample clearance and rugged construction must be provided.

Other changes were made in the code which will have their effect on all branches of the electrical industry. For instance, where the secondary system is grounded at the service, equipment grounds and the like may be connected to the circuit-grounding conductor by permission from the inspection department.

IDENTIFIED GROUND CONDUCTOR REQUIRED

All the grounding conductors of circuits consisting of No. 8 and smaller conductors must have an identifying color (white or natural gray). This applies to the neutral of three-wire circuits and the grounded conductors of two-wire circuits.

No circuit fused for more than 20 amp. is allowed in a metal raceway, and circuits of different systems are not permitted in the same conduit.

According to the revised code, one-conductor or two-conductor armored cable is allowed for concealed extensions in fireproof buildings if laid on the fireproofing. This also applies to one-conductor flexible conduit not smaller than ⅜ in. in diameter.

For decorative and theater lighting circuits the outlets connected per branch circuit cannot demand more than 15 amp.

A new requirement of particular significance to industrial concerns is the one that requires separate automatic cut-outs for each motor on cranes where more than one motor is required. An exception is made where two motors operate a single hoist carriage, truck or bridge and are controlled as a unit by one controller.

AIR-BREAK DISCONNECT FOR PRIMARY SERVICE

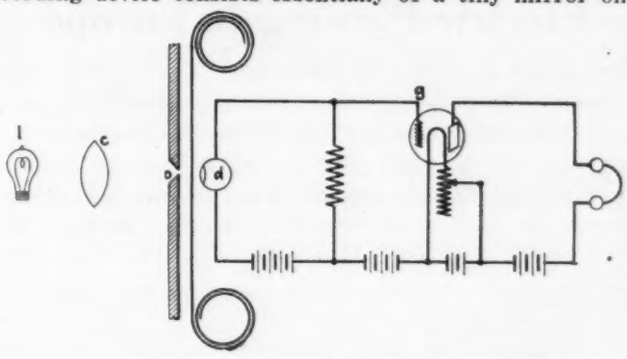
Where oil switches are used as service switches on connections taken from primary wires, an air-break disconnector is required between the oil switch and the supply. Switching and motor rooms for 601-volt to 5,000-volt circuits must be closed to unqualified persons.

The major addition to the code so far as fuses are concerned is the requirement of identifying marking to indicate their rating. For 250-volt fuses of 15 amp. or less a navy-blue label is required, and for fuses of greater rating green labels are required. Plug fuses of less than 15 amp. shall be distinguished by a hexagonal window or recess in the top, and the label shall also be hexagonal.

Some Details of the "Pallophotophone"

MORE details of the "pallophotophone," a device for recording and reproducing sound to which reference was made a short time ago in the ELECTRICAL WORLD, are given below and by the accompanying illustrations.

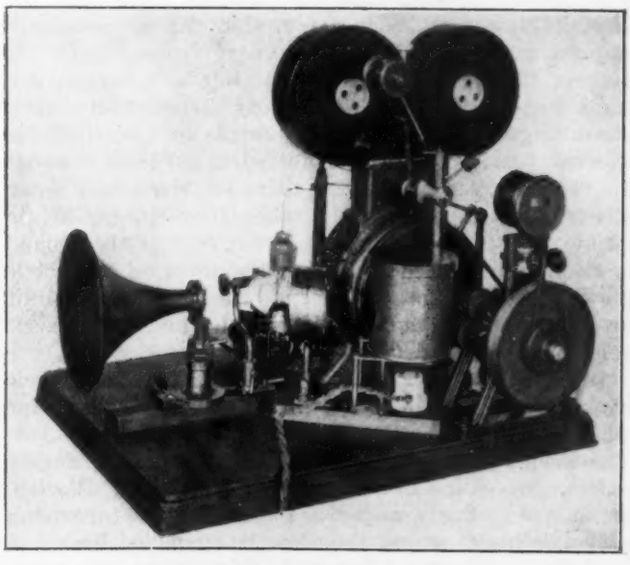
There are two distinct devices in this apparatus, one for recording sound and one for reproducing the sound, either of which may be used independently. The recording device consists essentially of a tiny mirror on



CIRCUIT DIAGRAM SHOWING APPARATUS USED

which is reflected a beam of light. This mirror is attached to a delicately adjusted vibrating diaphragm, and when sound waves cause the diaphragm to vibrate, the mirror oscillates and the ray of light causes the projection of corresponding oscillations upon a strip of photographic film which passes in front of the mirror in a continuous motion. The film is then developed in the usual way and when developed shows a succession of delicate dark markings which constitute the sound record.

In the reproducing system the operation of the apparatus is as follows: A photo-electric cell and two batteries are connected in circuit with the grid of a vacuum tube. Any change in the resistance of the cell will produce a corresponding change in the electromotive force impressed on the grid. When the film carrying the sound record passes between the cell and the light, the varying degrees of light which it permits to fall on the cell cause a varying amount of electron emission



VIEW OF ASSEMBLED UNIT OF "PALLOPHOTOPHONE"

in the cell and thereby create a potential difference in the grid circuit. Current then flows in that circuit in amounts directly proportional to the intensities of the light admitted to the cell through the film and at frequencies corresponding to the frequency of the vibrations recorded on the film. The remainder of the circuit and its action are similar to those of the standard radio transmitting equipment.

Electric Plowing in Europe

Implement Is Pulled by Caterpillar Tractor with Induction Motor Drive—Automatic Flexible Feeder of Bare Aluminum Feature of Swedish Invention

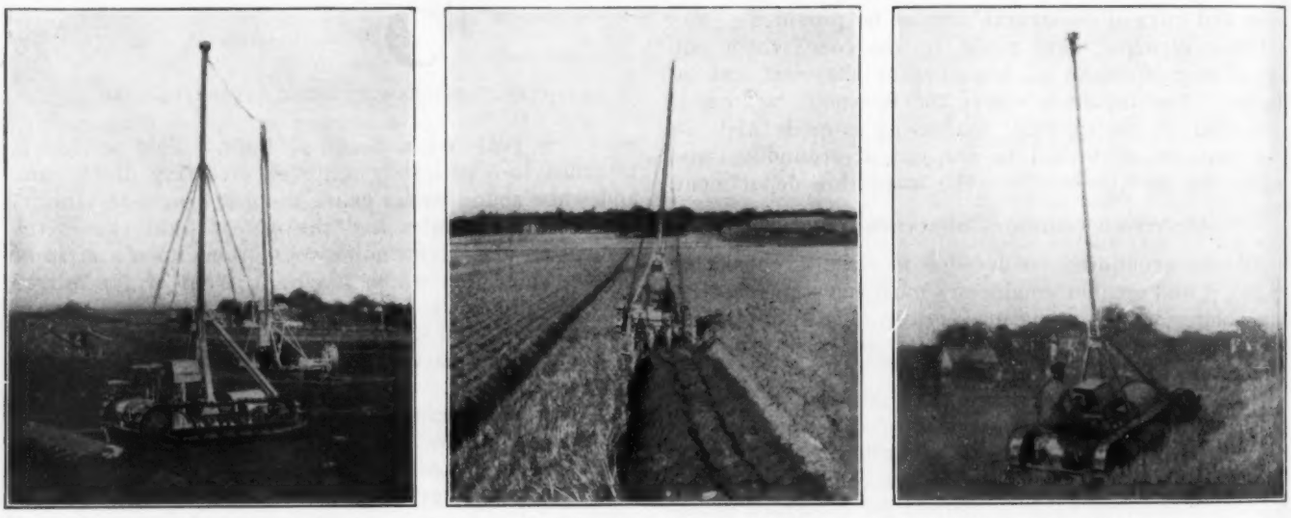
PLOWING the fields is by far the hardest labor on a farm and that which requires the greatest amount of energy per unit area, with the exception, perhaps, of water-spray irrigation. Much attention, therefore, has been devoted to the problem of designing an electric plowing outfit which will be cheap enough in actual use to compete with teams and gasoline tractors. Central-station men in rural districts naturally look upon the electric plow with much favor, since its adoption will mean a substantial increase in energy consumption per acre of the electrified area, resulting in a correspondingly better utilization of existing distribution plants. According to a survey recently made in Germany, the average yearly consumption for rural purposes is about 8.5 kw.-hr. per acre of cultivated electrified area. Electric plowing of a field takes from 16 kw.-hr. to 32 kw.-hr. per acre. Thus if 80 per cent of the ground is electrically plowed each year, the adoption of electric plowing will increase the energy consumption per unit area to from two and a half to four times its present value.

In Europe there are three radically different electric plowing systems in use, which may be called, for simplicity, the French, German and Swedish systems. The French system, which has been developed, among others, by the Compagnie d'Entreprises Electro-mécanique in Paris, makes use of a heavy motor wagon with two hoist drums, the plow being pulled back and forth by means of a long steel cable wound alternately on the two drums. The cable surrounds the field and has to be guided by two fixed drums and two other drums attached to anchoring wagons, one on each side of the field.

In the German system, which is due to the Siemens-Schuckert Company, two separate motor wagons are employed, each, with an 80-hp. motor. These wagons move stepwise one on each side of the field and pull the plow back and forth between them. An alternative scheme is to use only one motor wagon, the other one being replaced by an anchoring car with a free drum to double the cable back.

In the Swedish system Captain E. Grafström of Stockholm made a radical departure from former practice in electric plowing in designing his "electrotank," a caterpillar electric tractor which may be used not only for plowing but also for pulling harvesting machines and similar implements, and which therefore seems better than the cable-pull systems suited to compete with the gasoline tractor.

The "electrotank" equipment consists of two main parts, a stationary cable car and the tractor proper, connected to the car by an aërial feeder. The tractor is provided with a steering wheel and gear shift and is driven by a 15-hp., 500-volt, three-phase induction motor working on a worm reduction gear. The tractor weighs about 400 lb. and has a reverse and two normal speeds of about 131 ft. and 196 ft. per minute. The main feature of the invention is the aërial feeder, which consists of a flexible band of aluminum, built like a rope ladder, the three phases being carried parallel to each other in the same horizontal plane and kept apart by insulating spacers. The feeder is attached to a mast 20 ft. high on the tank and runs from there through free air to a similar mast on the cable car. The tractor mast is of steel tubing and the feeder band is joined to its top by a slip-ring arrangement permitting the tractor to move freely about its own axis. The mast on the cable car is hollow and made of wood, the bare feeder being carried down through the mast to an insulating drum, where it is rolled up in such a way that each phase coils concentrically on itself and no short circuits can occur. The drum automatically pays out the flexible feeder as the tank moves away from the cable car, the feeder always being kept taut by an automatic regulating device built on the slip-clutch principle and driven by a small induction motor. Some difficulties



GERMAN, FRENCH AND SWEDISH ELECTRIC PLOWING SYSTEMS HAVE BEEN DEVELOPED IN EUROPE

at first were encountered due to breaking of the aluminum band, but with a more recent design of regulator the tank may safely take ditches and other obstacles.

The length of the feeder is 738 ft. and the "electro-tank" thus is free to move within a circle with a diameter of 1,476 ft. Furrows 1,300 ft. long thus may be made in one stroke and a field of about 37 acres may be plowed without moving the cable car.

The energy consumption is about 17 kw.-hr. per acre, while the power varies from 12 hp. to 30 hp. The energy cost, therefore is about 50 cents an acre, at the rate of 3 cents per kilowatt-hour, and thus compares favorably with the cost of other plowing systems.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

National Aspects of Water-Power Development

To the Editors of the ELECTRICAL WORLD:

I note the letter of Francis A. J. FitzGerald on the "National Aspects of Niagara Falls Development," in which he criticises some of the statements made in my article on the "Pit River Power and Transmission Problem," printed in the ELECTRICAL WORLD for Jan. 27. Mr. FitzGerald should not have quoted incomplete sentences or statements.

I did not imply that there was no transmission of power from Niagara. I said: "To attempt to find a local demand for the *whole* of these large powers, as was done at Niagara, because in the early days of the electrical industry there were no transmission systems developed, is uneconomic and unsound for the industry and from a standpoint of national stability. For to be stable we should have the industries of the country diversified and spread out over the country as much as possible, building up the smaller communities as well as the large centers. At present places like Niagara, New York City, Boston, Philadelphia, Chicago and other places have much cheaper power than obtains in the smaller cities and towns. This does not make for a healthy growth of the states and nation. We need a transmission system which will take the power from the large producing centers to the smaller as well as the larger consumption centers and more nearly equalize power conditions in small and large cities."

Again I said: "It is not sound practice to allow *all* the water powers of Niagara to be used locally to the advantage of a few industries, but part of this power should be required to flow out into the smaller cities to help them prosper. Similarly, the water power of Muscle Shoals and other sites of great potentiality should not all be used locally to the advantage of a few industries, but a very large proportion of this power should find a market through the construction of transmission lines that will take it to available markets and build up present communities. In that way we will spread out the advantages of water power among more people, and this will in turn create a more favorable public opinion for the logical development of water power and transmission systems to meet the needs of the states and nation."

The real economic and political problem is given in the statement that there must be "created a more favorable public opinion for the logical development of water power." We cannot expect public opinion to favor the release of a reasonable amount of water for power at Niagara for local or other uses unless we get more people to know that they will get some direct benefits. It is a crime to have the waste going on at Niagara while we deplete our coal mines and talk about shortage of labor.

I believe the Niagara developments are a wonderful thing and that their local use was fully justified in the initial period of water-power developments, "because we had no transmission system developed." But if we are to get more water released for power for the use of industries at Niagara it seems inevitable that we must also take *part* of this power out to the smaller communities to get a more favorable public opinion. If it is wrong to give Henry Ford all the Muscle Shoals power to use locally, then it is also wrong to apply practically all the water powers at Niagara, St. Lawrence and other places to local use.

There can be no argument that the real solution of the power problem requires that it be cheaper to transmit energy electrically than to transport energy in the form of coal by rail. There can also be no argument that the transmission system must be commensurate with the large power units and stations. For the same reason that the size of the power units at Niagara and other places has increased ten times in the last ten or fifteen years the capacity of the transmission systems must be correspondingly enlarged. These are some of the economic reasons for the 220,000-volt transmission system.

If we apply reason to the water-power and transmission problems of the country, a plan can be worked out that will be a great benefit not only to the electrical industry but to the country as a whole. For the logical solution of the water-power and transmission problem will largely solve the coal and labor problems with benefit to all.

F. G. BAUM.

San Francisco, Cal.

Neglected "Safety First" Precautions

To the Editors of the ELECTRICAL WORLD:

We hear a great deal in these days of safety first and accident prevention campaigns, methods and systems, and they do much toward the end intended. It takes only the intelligence of a child to understand the danger of contact with 500-volt transmission lines, yet are these really the most dangerous features of the modern electric power plant? One does not think of any great danger from an ordinary 110-volt alternating-current lamp socket, nor from the composition of finishes for the handles of dusters or brooms, nor from the amount of conducting matter in paints used on ladders, insulating stools and other woodenware one sees daily in all power plants. To the danger from possible live lamp sockets I can testify from personal experience. While inspecting some apparatus on a shelf 10 ft. above the floor and holding a drop light inclosed in a wire guard in my right hand, in order to insure myself against a possible fall I grasped a cold 1½-in. steam pipe with my left hand. Instantly I found that my left hand had closed on the steam pipe with a death-like grip. I put forth my greatest possible effort to release my grip on the pipe, but it was utterly impossible to do so, and I realized the danger I was in. The thought flashed into my mind that the only thing to do was to let my body swing off the ladder, and this I did. I have no memory of what happened until I was

again on the floor standing on my feet with a severely sprained foot, considerable skin abrasion and a partly smashed ladder. I was still grasping the lamp just as I was holding it when the ground was formed. On investigation I found that a single strand of the flexible cord was in contact with the shell of the lamp socket, thereby energizing both socket and lamp guard with 110 volts to ground.

The accident related will indicate the care that should be taken when making the extension cords that are often used inside of boilers and penstocks and in so many places of low resistance to ground circuits. The use of portable lights tapped to the usual 550-volt railroad circuit lamp cluster should be absolutely forbidden as defective material or careless workmanship can easily result in injury or death. The finish on the handles of dusters and brooms often causes severe shock from moderate potentials. This, too, I can attest from experience. I advocate that all extension lights be made so as to preclude the possibility of a socket and guard becoming alive; that the quality of the finish on broom and duster and switch-hook handles and fuse tongs be of very high resistance. Paint on any of these articles must be forbidden in place of insulating varnish.

FREDERICK L. ROTH,
Assistant Chief Electrician.
Cos Cob Power Plant, N. Y., N. H. & H. R.R.

Automatic Operation of Hydro-Electric Plants

To the Editor of the ELECTRICAL WORLD:

The discussion in the ELECTRICAL WORLD regarding automatic hydro-electric plants has been very interesting. In the early spring of 1922 I had a good opportunity to make studies into the merits of automatic hydro-electric plants while installing and wiring the automatic equipment at the Breakwater plant of the Peninsular Power Company. This station consists of two 2,000-kva. generators and is entirely automatic. Since it has been in operation there never has been any doubt regarding its superior operating and economic features.

The automatic hydro plants are a distinct success, and the only limitation at present is that they will not attend to load dispatcher's requirements regarding line switching. To my knowledge there is not any safe method of opening a line switch automatically so that linemen can work on the line affected.

It has been proved to be economical to save the wages and housing cost of from two to three operators by operating small plants automatically. It will therefore be equally economical to design or change over larger plants to semi-automatic control, thereby dispensing with several operators. With semi-automatic control one switchboard operator could operate a large station where hand control might require an assistant switchboard operator and perhaps a governor man and a pump man to assist him.

The engineer who has the opportunity to design a large hydro-electric station at this time is indeed fortunate as manufacturers are able to supply him with governors and automatic electrical equipment which will safeguard his installation better than any operator could with manual control. Besides that, the starting and stopping of main units is far more satisfactory with automatic equipment. A 400,000-kw. plant consisting of eight 50,000-kw. units could readily be controlled as far as operation is concerned by one man. The controls of eight 50,000-kw. generators could be mounted on a panel 1 ft. high and 2 ft. wide. This panel would be mounted on the operator's desk. I would suggest that the generators each have separate excitation and an individual Tirrill voltage regulator. Assuming that there are times when a long high-voltage transmission line must be energized by building up the voltage gradually, this should also be taken care of automatically.

The diagram shows a 1-ft. x 3-in. panel section allotted to the control of one 50,000-kw. unit. Pulling the button *A* would start a generator and would stop it after the generator had backed off its load. It may be well to explain that there never would be any need of an operator stopping a generator quickly, as the generator is protected in every possible way by automatic devices, taking all emergency operations away from the operator. If it is desired to build the voltage up on a long high-voltage line, the operator will pull the *B* button as well as the *A* button, and the excitation of the generator will be so controlled automatically that this function will be taken care of quickly and in a neater way than with hand control. Perhaps it might be advisable to eliminate the *B* control and let the generator "think for itself" by connecting the secondary leads of a line or bus potential transformer so that when this potential transformer is energized the generator will get on the line in the usual way, while if the potential transformer is dead the generator will bring the voltage up properly for energizing a high-voltage line. *C* is a voltage-adjusting rheostat for the Tirrill regulator. By means of these eight rheostats the alternating-current voltage can be kept at the desired value and the power factor as it affects the generators regulated. *D* is to control the load of the generators with the ordinary paralleling motor if desired. It could also be arranged to prevent turning load control over to float switches or a distant load dispatcher. *E* controls a gate-opening-limit stop on the governor, thus enabling the operator to carry any set load. Perhaps it would be a good idea to have a remotely controlled indicator in view of the operator to show the governor-gate opening at all times. The line-control panels in a station of this kind should also be grouped very compactly, and instead of standardizing on one size of the meters they should have dials only large enough to get the desired results. For instance, a 50,000-kw. meter should have a large dial while a power factor or exciter voltmeter would need only a very small dial.

I made the statement that one man could handle the operation of a station of this size or even larger. There would, however, be maintenance and cleaning to be attended to which would require other help, depending on local conditions. In selecting the size of a crew in a plant of this kind the number of men needed for maintenance would compare closely with the number needed in the same plant if it were hand-operated.

I predict that the steam station will also be controlled in a similar manner in the future. Bringing a large steam turbine up to speed and on the line automatically is not going to be too complicated a problem for engineers to solve, and when it is solved the method will be far superior to manual operation.

L. W. WYSS,
Iron Mountain, Mich. Peninsular Power Company.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Relay as Ground Detector for D.C. Control Bus

WHERE lamps as ground indicators are installed on direct-current control buses very annoying operating troubles are often encountered. Consequently the New York & Queens Electric Light & Power Company has done away with these lamp ground detectors and substituted for them a differential relay, the use of which has so far proved to be very satisfactory.

In order to be sure whether or not the direct-current system was free from accidental grounds, it was formerly the practice to install lamps on the direct-current bus, as shown in Fig. 1. When neither side of the bus was grounded, the lamps burned at half the direct-current bus voltage, but when either side became grounded the lamp on the opposite side burned with full voltage while on the grounded side the lamp was extinguished. With the lamp ground detector on the bus, it was found that transformer banks or feeders would often trip out without apparent cause. The operator would reclose the switches twice, but they would trip out immediately, and the operator would then leave the circuit off. The lamp ground detector would then show the direct-current system to be free from grounds. However, when the control wiring of the circuit which had tripped out was tested it would be found to be grounded, and after the removal of the ground the circuit would function properly with no further trouble.

The trouble was found to be due to a ground occurring on the control wiring between the "CO" relays and the "HG" relays, which were used to separate the relay trip leads on the oil-circuit-breaker circuits. Fig. 1 schematically shows the control connections on a typical feeder circuit. The wiring would accidentally become grounded say between points *A* and *B*. This would mean that the negative bus would be grounded through the "HG" relay on the particular oil switch that was closed at the time. The current taken by the lamp and "HG" relay in series between the grounded side and the ungrounded side of the bus was sufficient to cause the "HG" relay to operate and trip the breaker.

In order to avoid trouble of this sort, for which the lamp ground detectors were more or less responsible, they were removed and an entirely new system was installed for the detection of grounds on the direct current bus, as shown in Fig. 2. A type E-117 Western Electric differentially wound telegraph relay, which operates on a few milliamperes, was installed with 2,000 ohms resistance in each side and with the middle point of the winding solidly grounded. In addition to operation on a current of such small magnitude that no other equipment would be affected, this relay is equipped with contacts that may be connected to ring a bell, light a lamp on the operator's desk or give any other desirable indication of trouble. In our substations a 110-volt bell is used.

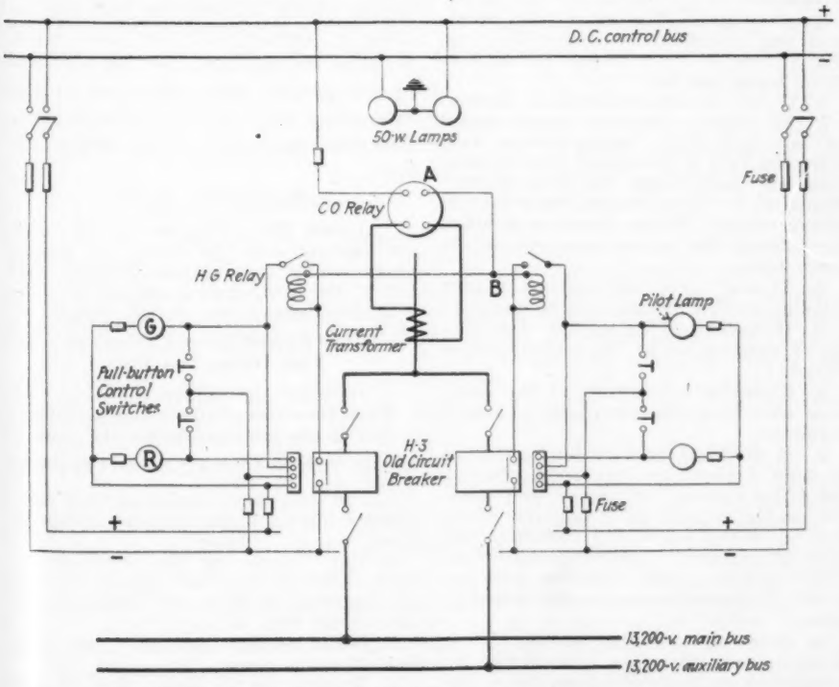


FIG. 1—GROUNDING OF CONTROL WIRE BETWEEN RELAYS CAUSES CIRCUIT TO OPEN

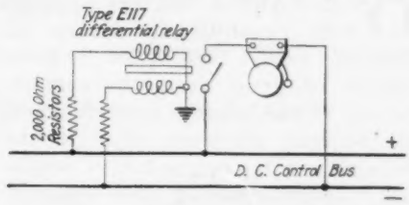


FIG. 2—DIFFERENTIAL RELAY AS GROUND DETECTOR

This system has been in operation for over two years and has been found to be entirely reliable and satisfactory. It is now installed as part of the standard equipment on the direct-current buses for the operation of oil circuit breakers.

J. E. GOODALE,
Electrical Design Engineer.
New York & Queens Electric Light & Power Company,
Long Island City, N. Y.

Respiratory Protection in Street Manholes

WORKERS in street manholes for telephone and electric power conduits often encounter irrespirable atmospheres due to leakage of artificial or natural gas, sewer gas or gases caused by electrolysis. Inquiries received by the Bureau of Mines and

conferences between members of the bureau and engineers who have to deal with manholes have disclosed the need at times of respiratory protection for workers in manholes. It is planned by the bureau to obtain samples of contaminated air from manholes and to test various masks in them. Recommendations for protection of workers in manholes will be published. This experimental work is being conducted at the Pittsburgh (Pa.) experiment station of the bureau.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Extracts from an Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

Starting Rotary Converters from the A.C. Side

ON ROTARY converters equipped with brush-lifting devices all brushes except the pilot brushes should be lifted from the commutator. If the brushes are left down, short-circuit currents occur in the coils undergoing commutation, resulting in severe sparking when this current is interrupted and in the burning of the commutator and brushes. Starting switches are provided to impress less than the normal voltage across the alternating-current end of the machine as the current must be limited to a safe value.

Proper polarity is essential as reversed polarity would cause the machine to act as a short circuit to a bus already energized. Therefore, when the machine has reached maximum speed with the switch in the starting position, the shunt-field switch is closed when the voltmeter needle swings in the positive direction. Sometimes it is impossible to make a machine build up in the proper direction by means of the reversing switch. In this event, when running on the starting side, the oil switch should be opened for a few seconds and closed again. Opening the switch for the proper period will cause the armature to slip one pole space from its original position. Opening it for too long or too short a period will cause the armature to slip two poles, or none, either of which conditions leaves the polarity as before. Consequently, if the first attempt to reverse the polarity by this method is not successful, it should be tried again with a longer or shorter period of opening the oil circuit breakers.

If it is attempted to operate compound-wound machines in parallel without equalizing connections, one machine will take all the load and also feed back into the others and operate them as motors. Equalizer buses and switches are provided to cause proper division of the load current among the series fields, thereby overcoming this tendency.

These general instructions for operating rotary converters with the following definite instructions as to each successive step to take in starting are part of the operating code of the Philadelphia Electric Company:

1. If the machine has a brush-lifting mechanism, see that the direct-current brushes are raised and that only the pilot brushes remain on the commutator. Otherwise all the brushes must remain down.
2. If a main field break-up and reversing switch is provided, see that this switch is left open. If a field reversing switch only is provided, see that this switch is left closed in the running position, unless the switch is provided with a field discharge resistance, in which case it should be left open.
3. See that the booster-field switch is open.
4. Cut in all the main-field resistance and connect the voltmeter by plug, dial switch or other means to the machine being started.
5. If the transformer bank supplying the rotary converter is air-cooled by an individual motor-driven fan, start the fan; if air-cooled from a common air duct, open the transformer dampers; if water-cooled, turn on the cooling water. Where fans are supplied for cooling the rotary converter, start these fans.
6. Throw the alternating-current starting switch to the starting position.
7. If necessary to obtain the voltmeter reading, close the negative bus switch.
8. Close the oil switch, at the same time observing the alternating-current ammeter.
9. If the main-field switch, as stated in Rule 2 above, is left open, observe the direct-current voltmeter, and when the needle swings in a positive direction, close the main-field switch in the running position. Where the main-field switch is left closed, note the direction in which the voltmeter needle comes to rest.

In either case, if the field builds up in the reverse direction, as indicated by a negative voltmeter reading, throw the main-field switch to the reverse position; then, when the voltmeter needle swings slightly to the positive side of the scale, throw the main-field switch to the running position.

If a machine does not build up in the right direction after several trials of the above method, proceed as follows: With the starting switch in the starting position, open the oil switch and close it again in a few seconds. In case the voltage does not build up correctly, repeat the above operation, keeping the oil switch open for a slightly shorter or longer period of time as may be found necessary.

10. Close the booster-field switch.
11. Throw the alternating-current starting switch to the running position.
12. Lower the main brushes on the commutator.
13. Close the equalizer and series-field switches. (The series-field switch is provided only on machines having a shunt around the series field on the main-field spool.)
14. Close the neutral switch (on three-wire converters).
15. Where knife switches are provided in series with circuit breakers, close the circuit breakers.
16. Adjust the direct-current voltage to that of the bus.
17. Close the negative bus switch, if it has not been closed under Rule 7.
18. Close the positive bus switch.
19. Load the converter by field adjustment.

Hot Stoker Rams

HOT upper stoker rams may be caused either by the burning out of the ram-box cap in the front wall or by an obstruction over the ram, preventing coal from feeding. In either case the coal in the hopper will become ignited, which will heat the rams and ram boxes. Hot lower rams are caused by clinker formation between the tuyères or by insufficient feeding of coal by the rams, which allows the hot coal to come in contact with the lower rams. Typical instructions for taking care of hot stoker rams are part of the operating code of the Philadelphia Electric Company and are given below:

HOT UPPER RAMS

1. Break the arch over the ram with air agitators or by hand, or should there be an obstruction, dig the coal out of the hopper and remove it.
2. Feed green coal to the ram.

HOT LOWER RAMS CAUSED BY FIRE BEING TOO THIN

1. Increase the stoker speed.
2. Reduce the drafts when possible.
3. Put the long stroke on the ram.

HOT LOWER RAMS CAUSED BY CLINKERS

1. Put the long stroke on the ram, alternating with the normal stroke to break up the clinker.
2. Put U-pins on the end of the lower-ram driving bar outside of the driving link to draw the ram further out of the fire.
3. Dislodge the clinker with bars from the side doors.
4. Reduce the air blast, if it is possible to hold steam.
5. If this fails, take the boiler off the line and remove the clinker.

Regulations Proposed for Installation of Pulverized-Fuel Systems

REGULATIONS covering the installation of pulverized-fuel systems have been prepared by a subcommittee of the National Fire Protection Association and approved by the main committee on dust explosion hazards and will be recommended to the annual meeting of the association for tentative adoption at Chicago on May 8-10, 1923.

Any one interested in these regulations and desiring to suggest additions or changes should communicate prior to the May meeting with David J. Price, United States Bureau of Chemistry, Washington, D. C.

Some of the major requirements as set forth in the regulations may be found in the accompanying tabulation. The general regulations for Class A and Class B systems relate to location and construction of apparatus, ventilation and dust collection, static dust, crusher and pulverizer, magnetic separators, dust collectors, driers and fire protection. Mechanical details such as piping, joints, valves, storage and furnace bins, screw conveyors, etc., are specified in the regulations for each of the various types.

An instruction card emphasizing precautions to observe in operating pulverized-fuel plants must be posted in a conspicuous place in the pulverizing plant, the boiler plant and in buildings where pulverized fuel is used. Among the major precautions to be included on this card are:

The use of shavings or other similar light combustible materials for starting fires in drier furnace is prohibited.

In Class B systems, if the fuel supply line becomes clogged, the furnace shall be immediately cut off and the secondary air stopped. When the obstruction has been cleared and before starting the fan a thorough examination shall be made to insure the removal of smoldering particles of fuel.

Some Regulations Covering Installation and Operation of Pulverized Fuel Equipment to Be Voted On May 8-10, 1923

Class A.—Indirect, or those in which the fuel is intimately mixed with air only at the point or points where used and involving storage bins at points of consumption.

Class B.—Direct, or those in which the pulverized fuel is fed to a fan by which it is blown as a combustible mixture through large pipe to furnaces or other points of combustion. In the case of circulating systems of this class the unused fuel is returned to the initial point to again be blown through the line.

Unit System.—Those in which the fuel is pulverized at or near the point or points of use and delivered directly from the pulverizer into the furnace by means of fan or blower, which may be an integral part of the apparatus, the air being admitted in the apparatus or in conjunction with the fuel.

General Regulations

Class A and Class B Systems

Location.—The processes of crushing, drying and pulverizing fuel shall be accomplished in a separate building used for no other purposes.

Construction.—In order to prevent accumulations of dust, the design of the building shall be such and the structural members so shaped and assembled as to present the least possible extent of surface on which dust can lodge. In order that the venting of explosions may be more readily facilitated, a portion of the exterior walls equal to not less than 10 per cent of the combined area of the inclosing walls shall be of glass, provided that when in a building with other processes not more than 40 per cent of the aggregate area of the exterior walls shall be of such material.

Ventilation and Dust Collection.—The atmosphere of the room shall be kept as free as possible from suspended or floating dust by means of approved dust-collecting systems, the collection of dust to take place as near the point of origin as possible.

Static Dust.—Portable tanks containing compressed air may be used provided that no electrical equipment is operated inside the pulverizing room in connection therewith.

Magnetic Separator.—A magnetic separator shall be provided for each system employing pulverizing mills and installed between the crusher and the drier.

Driers.—The drier and drier furnace shall be separated from other equipment in the pulverizer house by means of incombustible partitions constructed of material having a fire resistance of not less than one hour based upon the standard specifications for fire tests and materials of construction. Pulverized coal exceeding a temperature of 150 deg. F. shall not be stored in any bin.

Class A Systems

Storage and Furnace Bins.—Storage and furnace bins shall be located as far from furnaces as is consistent with operating requirements. Bins . . . shall be so shaped that no material will be left in the corners under normal emptying operation of the bin. All bins shall be equipped with a reliable gaging device so that the quantity of fuel in the bin may be readily determined without exposing contents.

Screw Conveyors.—Systems using screw conveyors for handling pulverized fuel shall be arranged with driving power applied at the discharge end. In no plant shall coal-storage bins, conveying machinery or fuel-pipe lines be used as supports for electric lighting or power lines other than those installed in conduit. Machinery and all other parts comprising the crushing, drying, pulverizing and conveying system shall be electrically grounded in an effective manner.

Class B Systems

Blowers.—The primary blower shall be operated and maintained at a rate producing a primary air pressure higher than that of the secondary or booster. Motor circuits for primary blower and booster fan shall be protected by the same circuit-breaker switch or other protective device, so that the stopping of either will cause the simultaneous stopping of the other.

Unit Systems

Pulverizer.—Power for operation of the pulverizer shall be controlled remotely at a readily accessible location and at the mill.

Magnetic Separator.—A magnetic separator shall be provided for each system.

Vent.—A pressure-relief vent discharging to the outside air shall be provided in the discharge of every pulverizer, having discharge pipe greater than 4 in. in diameter and exceeding 20 ft. in length. All pulverizers shall be constructed as dust-tight as practicable and so operated as to avoid emission of dust.

All stationary lights shall be protected with vapor-proof globes and wire guards. Only daylight or hand flashlamps shall be used when inspecting coal-storage bins and pulverizing and coal conveying apparatus. All conveying and distributing piping shall be inspected daily and any leaks that are found promptly repaired.

FIELD EDITOR ELECTRICAL WORLD.
New York, N.Y.

Maintaining Dielectric Strength of Oil

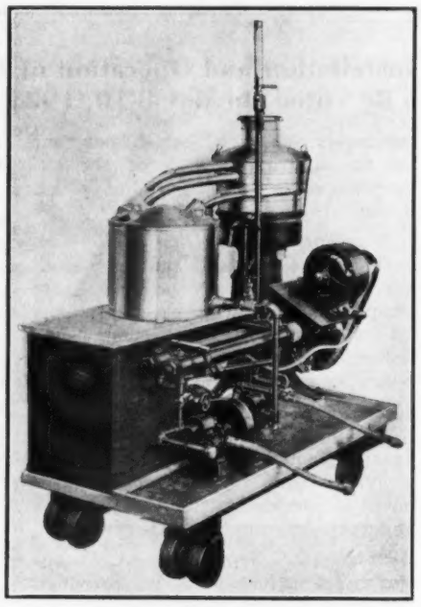
Dehydration of Transformer Oil by Centrifugal Separator Is Proving Successful—Advantages Are Speed and Economy—Apparatus Can Also Be Used for Purifying Lubricating Oil

EXPERIMENTS conducted during the past three years by one large central station company located in the East have demonstrated that the method of separation by centrifugal force can be successfully applied to the problem of removing water from transformer oil. As an illustration of a typical experiment in dehydration of transformer oil by a centrifugal separator the following test may be cited:

The transformer used was a 625-kva. unit, 2,300/440 volts, containing No. 12 transil oil. The temperature varied between 42 deg. and 48 deg. C. during the test. Approximately 530 gal. of oil were run through the separator, at a rate of 50 gal. to 150 gal. per hour. This speed could have been exceeded except for local conditions, a rate as high as 350 gal. an hour having been obtained in other tests. The dielectric strength of the oil was determined in each case by averaging the breakdown value obtained by testing five samples of oil in an oil test cup with ½-in. electrodes, 0.2 in. apart. The transformer was not in service at the time. The results of these tests are given in the accompanying table. In similar tests using a gap with 1-in. electrodes 0.1 in. apart dielectric strength as high as 32,000 volts have been obtained.

The apparatus now used for the dehydration of transformer oil is the result of the experiments made in the last three years. It consists of a motor-driven centrifugal separator, together with an electric driving motor, pumps, heater and oil tank, all mounted upon a movable platform. The fact that the apparatus is portable makes it possible to move it easily from one location in the power house to another or to roll it up a gangway onto a motor truck and carry it to various substations. At a large generating station it can remain permanently piped to all of the transformers and be used solely for their dehydration, but where there is not a sufficient number of units to keep one separator busy all the time the portability feature is a great asset.

The general practice in using this equipment is to draw off a sample of oil from the bottom of each transformer once a month and send it to the company's laboratory for testing. In this testing the 0.02-in. gap is habitually used because it is thought to give more reliable results. When the dielectric value of the sample of oil falls below 26,000 volts, the transformer is dehydrated by the centrifugal separator.



CENTRIFUGAL SEPARATOR PROVING SUCCESSFUL FOR PURIFYING OIL

The advantages which have been found to result from the use of the centrifugal separator for dehydrating transformer oil have been, primarily, increased speed and decreased cost. It was usually necessary with the blotter press to run the oil through the filter at least three times in order to purify it thoroughly. A transformer containing 2,400 gal. of oil would require forty-eight hours for dehydration by a medium-sized filter. Additional time would be required for changing blotters, taking apart and putting together the apparatus. On the other hand, a centrifugal separator could probably purify that quantity of oil in about twelve hours.

Not only is it possible for fewer men and fewer machines to do the work by the new method, but there is also the additional advantage that it is frequently possible to take a transformer out of service for a short period for dehydration, when it might be quite impossible to keep it out for many hours. The centrifugal separator therefore makes it feasible at times to dehydrate the oil completely under circumstances such that it could not be done by the slower filter press.

An illustration of the usefulness of speedy dehydration is furnished by the following experience with a transformer. It was discovered that a small pinhole leak in the copper tubing was allowing a minute quantity of water to mingle with the oil. Although the rate of leakage was low, nevertheless the dielectric value of the oil was rapidly reduced. It was most important that the transformer remain in service, so a portable centrifugal separator was brought over and set to work, while the transformer remained alive. After the oil had been dehydrated once the separator was left in place and tests were taken of the oil every hour. Whenever the dielectric value fell below 30,000 volts the purifiefir was set to work to restore it to the vicinity of 50,000 volts. In this way it was possible to keep the transformer in service for several days in spite of the leak at a time of peak demand when the loss of any apparatus would have been a serious inconvenience.

The existence of some solid matter in the transformer oil is clearly shown whenever the centrifugal separator is cleaned. A kind of sludge somewhat resembling vaseline is found to have gathered in the dirt pockets. This is probably composed

DIELECTRIC STRENGTH OF OIL IN A 625-KVA. TRANSFORMER UNDER TEST

Time	Dielectric Strength of Oil at Intake, in Volts	Dielectric Strength of Oil at Outlet, in Volts
8:15 a. m.	14,000	21,000*
8:30 a. m.	First oil repeated	40,000
8:45 a. m.	29,000	42,000
9:30 a. m.	45,000	48,000
9:45 a. m.	46,000	†
10:15 a. m.	49,000	†
10:45 a. m.	50,000	†
11:30 a. m.	49,000	†
12:30 p. m.	51,000	†

* This oil was not considered fit to be returned to the transformer and was put through separator again.
† No breakdown values obtained—dielectric strength above 52,000 volts, the capacity of the testing machine being 52,000 volts.

of metallic particles from the terminals, ingredients of the insulating varnish and so forth. The sludge accumulates so slowly, however, that it is possible to treat a transformer completely without its being necessary to stop the separator for cleaning. In this respect the centrifugal separator possesses a distinct advantage over the press filter, whose blotters have to be frequently renewed. The time required for taking apart the machine, cleaning out the dirt pockets and putting it together again is about forty-five minutes.

There are now many installations of this type of apparatus. The blotter-press method has not been altogether abandoned, because it is thought to be superior for removal of some foreign substances, such as the carbon in switch oils. Apparatus for both methods is therefore kept available, and its use is governed by the circumstance of a particular case.

Carbon has been successfully removed from switch oil by washing with soap, allowing the mixture to settle and then dehydrating the oil. By this process the dielectric value of the oil was brought back to standard and its clearness restored.

Where a unit must remain alive during dehydration there is a possibility that the first oil coming through the separator will not be fit to be returned, and if it should be poured back into the case, a breakdown might result. If, however, the oil in the transformer be of fairly high dielectric strength to begin with, or if the unit be dead during the dehydration, this danger will be avoided. It should then be possible to utilize the centrifugal separator readily and to accomplish improved speed and reduced costs in the removal of moisture from transformer oils. The fact that the same machine can be used after a slight change for the purpose of purifying lubricating oil brings it within the reach of smaller companies as well as those which use power on a large scale.

New York, N. Y. J. A. MILLER, JR.

Restoring Flooded Generators to Service

THE superintendent of construction and maintenance of a power company operating in the Southern States declares that he is not afraid to place back in service a generator which has been totally submerged in water. His confidence is based on experience with 6,600-volt generators which were submerged during the record flood of 1919. The coils were dried out by short-circuiting the phase leads and operating the generators at such speed and excitation as would maintain the rated allowable overload current in the windings. In general this drying-out process required about two weeks for each unit, whereas it would have required at least thirty days to rewind the generators if coils had been immediately available and a longer delay would have ensued if the coils had had to be shipped. Moreover, the cost of rewinding would have been about $25,000 per unit.

The length of time that the coils should be subjected to the drying current was determined by megger readings. No definite resistance was selected as the limiting value. Instead megger readings were taken from the start of the drying process. The curve plotted between time and resistance dropped off rapidly immediately after starting the process and then rose at a gradually decreasing rate until the resistant became constant. After the resistance had been constant for twenty-four hours the generator was considered ready for service.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

POWER COMPANY

RECORD OF DRYING No. MAKE VOLTS AMP. K. V. A.

AT STATION. BY PROCESS. DATE

TIME	AMP.	VOLTS	AMP. FIELD	VOLTS FIELD	TEMP. COILS	TEMP. IRON	TEMP. INGOING AIR	VACUUM	MEGGER	MEGGER	MEGGER	LOG
7.00 A.M.												
7.30												
8.00												
3.30												
4.00												WEATHER 7 A. M.
4.30												" 12 N.
5.00												" 7 P. M.
5.30												" 12 M. N.
6.00												SIGNED
6.30 A.M.												O. K.

☞ THIS RECORD MUST BE KEPT IN DUPLICATE, AND ORIGINAL MAILED TO CHARLOTTE OFFICE EACH DAY

TYPICAL DRYING OUT DATA FORM FOR GENERATORS THAT HAVE BEEN TOTALLY SUBMERGED DURING A FLOOD

Pole Treatment Does Not Affect Conductivity

THE question as to whether treated poles have less resistance than untreated poles and for that reason are a source of danger to linemen called upon to work on them has been a subject of considerable discussion, particularly where poles treated throughout their full length are used. A committee of the American Wood Preservers' Association reporting at its convention last January had the following to say on the subject:

Poles.—Your committee has decided that for all practical purposes the conductivity question as related to poles holds no interest for the following reasons:

1. The distribution engineer is concerned with insulator and cross-arm resistance, the pole resistance forming but a small fraction of the circuit to the ground.
2. Creosote and gas oil are the preservatives in general use for pole preservation, and the experimental data show that they increase resistivity of timber.
3. Steel poles and cross-arms are in common use on transmission lines.

We have asked the opinion of the N. E. L. A., and it agrees that pole conductivity does not enter seriously into transmission or distribution line construction.

Tests on the Conductivity of Treated Wood.—A number of investigators have studied this effect and have covered the subject thoroughly at least from a qualitative standpoint. J. T. Butterfield found that:

1. The resistance varies inversely with the amount of water present, the moisture being between the limits of 15 per cent and 50 per cent, also inversely with the length of the tie and with the temperature.
2. The resistance is lowest when with the grain and highest along the year rings or radial lines.
3. Treatment with a soluble salt does change the resistance of the tie and varies approximately inversely as the amount of salt present.
4. Creosote does not decrease the resistance.
5. All the data obtained tended to establish the view that the conductivity of wood is due to the presence of an electrolyte in the pores of the wood formed by an aqueous solution of the salts found in the natural timber or of salts artificially introduced.

Various tests and observations on ties made over a period running back to 1914 were submitted by the committee at this meeting.

The conclusions quoted are borne out in these data in that creosote-oil treatment in which pole users are interested does not decrease the natural wood resistance to the flow of electricity. Treatments utilizing soluble salts do change the resistance of any wooden poles.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Central-Station and Community Growth Inseparable

HOW the interests of an expanding community tie in with the development of a great central-station system is being shown in a group of advertisements now being published at Boston as planned by the Edison Electric Illuminating Company upon themes suggested by recent progress in its public service. The first three of these displays, which have been carried in daily suburban and financial newspapers in the company's territory of about 700 sq. miles on a regular time schedule, are reproduced herewith. The first draws a lesson from the peak-output record attained by the system on Dec. 21 last, the anniversary of the landing of the Pilgrims at Plymouth. The "set-up" emphasizes the two advances the date signified and calls attention to the fact that in meeting service requirements of a growing community the previous record output of the company was exceeded by 24 per cent. The contribution of the individual demand for service to the growth of company and community is featured.

A look ahead to the new Weymouth generating station is the basis of the second display, which emphasizes the need of foresight in anticipating the electrical growth of the community through arithmetical studies of load development and available facilities. The third insert goes a step farther and shows how the new 300,000-kw. station to be built at Weymouth will serve the entire metropolitan and suburban area of Greater Boston, with major tie lines to the principal substations and to the present L Street Station in Boston proper. The controlling factors in the decision to locate at Weymouth are set forth, and the diversity of interests served by the company from the farms of Millis to the tidewater industrial plants of Boston and Chelsea are outlined. Later advertisements will point out the importance of coal and the unity of interest in the development of both the community and company.

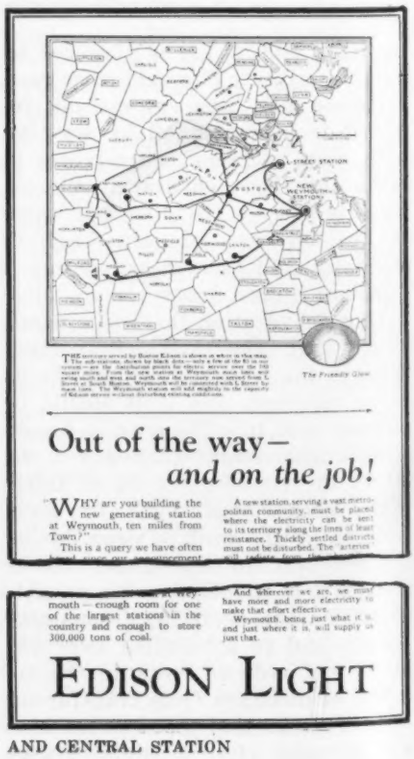
Use of Electricity Reduces Number of Fires

BECAUSE of its increased application in the household and in industrial plants electricity is a potent factor in fire prevention. It has reduced the number of fires in Denver, Col., by more than 95 per cent in the last five years, according to a study and survey recently completed by Fire Chief Healy of the Denver City Fire Department. The increased demand for electricity for light, heat and power purposes has curtailed the actual number of conflagrations by at least 95 per cent, he believes. In short, not more than one fire in a thousand—probably even fewer—is caused by electricity when used properly.

Chief Healy grouped the few fires of electrical origin in the following three general classes: Fires over which ordinary precautions exert little control, such as conflagrations due to interference with transmission lines by falling trees, storms and the like, lightning and static electricity;

1620
The L Street Station of Boston Edison in South Boston, with a capacity of 260,000 horsepower. On Dec. 21, 1912, Boston Edison supplied enough electricity to light eighty million 25 candlepower lamps for an hour — enough lamps to circle the United States, if set only 9½ inches apart. Note the 75,000-ton coal reserve.
The Friendly Glow
On that day a great city leapt forward!
THERE are two million people in this Greater Boston of ours — a great forward-moving body, whose progress is as inevitable as the hands of a clock, and so gradual that the eye can't see it move.
But on December 21, in the twilight of the passing year, we saw this city move!
December 21, if you recall, was not an extraordinary day in weather — just a busy Thursday, with Christmas in the air. By a trick of fate, it was the anniversary of the landing of the
We saw a trainload of coal, 44 cars of 40 tons apiece, used that day to drive this city ahead.
And we saw Greater Boston even straining at its boundaries to reach a helping hand to neighbors outside, for that day we supplied 226,000 kilowatt hours of power to territory beyond Greater Boston.
That was your great day
Where were you on December 21? What improved
contrast the power of 179,000 horses, commanded by a lever here, a button there, to make Greater Boston — greater.
Boston Edison Company a needle shows your command, a current flashes in response —
and a city moves forward!
EDISON LIGHT

Airplane view of 80-acre site at Weymouth for new Boston Edison generating station, with capacity of 600,000 H. P. and 300,000-ton coal storage.
The Friendly Glow
A step today, and— you can meet tomorrow
IT used to be New Downer's Landing — a picnic grove.
likely that the two million others in Greater Boston will have the same
300,000 tons of coal — enough to make electricity for Greater Boston for 170 days like last December 21st.
And it is built by simple arithmetic!
How do we dare build so far beyond the maximum of present requirement? By simple arithmetic. You aren't likely to come to us today for twice the electricity that is now helping you to live and work more easily and more effectively; even if you do, it isn't
be, and to meet it even before you know your needs yourself.
Arithmetic plus Faith
Every calculation we make looks forward. Every record we have shown it has stepped forward. Our simple arithmetic is based on the relentless advance of Greater Boston in a common spirit that for nearly three centuries has made this city greater every year.
That sort of figuring is called Faith. Faith is one way and two-sided. We grow together.
EDISON LIGHT


L STREET STATION
NEW WEYMOUTH STATION
The Friendly Glow
Out of the way— and on the job!
WHY are you building the new generating station at Weymouth, ten miles from Town?"
This is a query we have often
A new station serving a vast metropolitan community, must be placed where the electricity can be sent to its territory along the lines of least resistance. Thickly settled districts must not be disturbed. The arteries
mouth — enough room for one of the largest stations in the country and enough to store 300,000 tons of coal.
And wherever we are, we must have more and more electricity to make that effort effective.
Weymouth, being just what it is, and just where it is, will supply us just that.
EDISON LIGHT

ADVERTISEMENTS CO-ORDINATING THE DEVELOPMENT OF COMMUNITY AND CENTRAL STATION

fires caused by abuse and carelessness in the use of electric appliances, and lastly, tampering with fuses and the use of other material than approved fuses; deterioration of installations and defective equipment.

The Denver Fire Department is gratified to report that few fires are actually attributed to defective equipment, he declared. The relative number due to such causes as neglect to disconnect flat-irons shows some tendency to increase.

Twenty-four conflagrations occurring in Denver over a period of two years which were attributed to electricity were shown by Chief Healy to be due to other causes entirely.

Cooking Schools Stimulate Range Sales

TO PROMOTE the sale of electric ranges by educating the housewife in the use of this appliance the electrical interests of Portland, Ore., and Seattle, Tacoma and Spokane, Wash., recently joined daily newspapers to conduct electric cooking schools in each of these cities. Results proved highly satisfactory from the point of attendance, and the schools proved to be an excellent means of arousing interest in electric cooking.

The plan was first to sell the idea to a newspaper in each of the cities and have the school conducted under its auspices as the "*News-Tribune* Electrical Cooking School." The advertising and additional prestige gained amply repaid the newspaper for its support. Advertising by the power companies, electrical dealers and merchants whose products were used in the school, together with news items on electric cooking and concerning the school, created a strong appeal. A large hall was obtained in which merchants and manufacturers who participated in the advertising were allowed to maintain display booths and give out samples but not to solicit sales.

ATTENDANCE AT FOUR ELECTRIC COOKING SCHOOLS

City	Population	No. Days School Was Conducted	Maximum Attendance	Average Attendance	Entries in Baking Contestt
Seattle	315,000	5	1,500	1,000	987
Spokane	104,000	5	650	500	627
Tacoma	97,000	5	1,400	1,200	1,164
*Portland	258,000	5	600	600	620

* The largest hall available in Portland had a seating capacity of only 600. It is interesting to note tha Tacoma, with the smallest population of all of the four cities, had the largest attendance.

The success of such an undertaking depends largely upon the demonstrator, who should have a pleasing personality, be a good speaker, be familiar with every phase of the culinary art and be able to present the superior features of the electric range. For this purpose the services of Miss Bernice Lowen, home economist of the Edison Electric Appliance Company of Chicago, were secured.

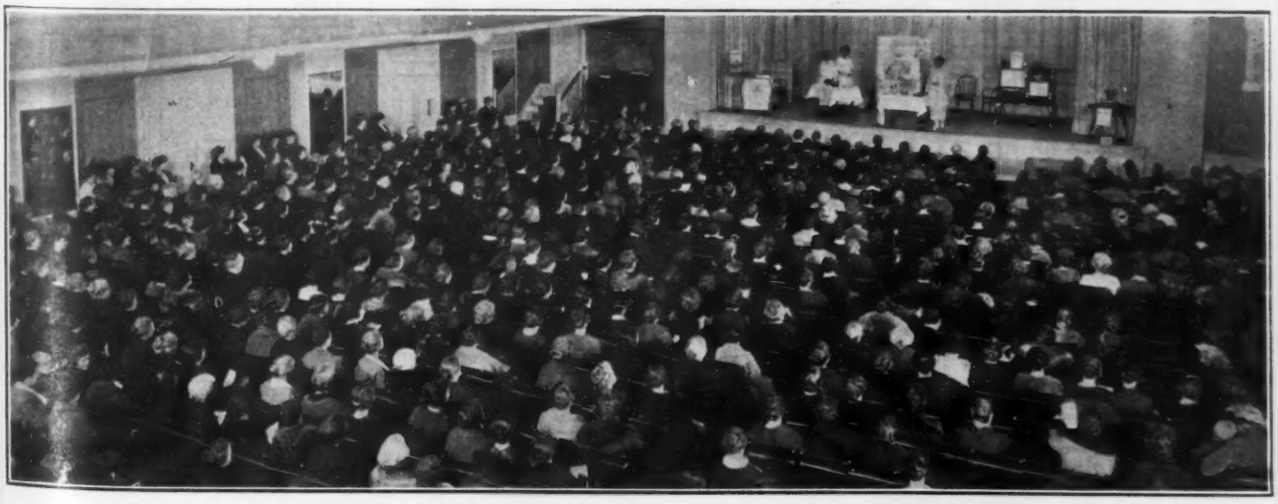
Interest was maintained by holding a baking contest on the last day of each school, when prizes were awarded for the best loaf of bread, the best cake and the best pie entered. An electric range, a washing machine and a vacuum cleaner were given as first prizes for these entries. In addition to the first prize ten other prizes were awarded in each division. The entries were judged by the standard scale adopted by the bakers' association. All entries in the baking contest were accepted with the understanding that they would not be returned. These were sold instead, and in most cases the money was given to charity. A question box conducted by the demonstrator also proved valuable in spreading the story of electrical cooking.

The results of this method of educating the housewife to the superiority of the electric range are largely intangible, although a number of direct sales resulted. It is probable, however, that the full benefit will not be felt for many months. The interest created by the schools and the results which may be expected can best be judged from the accompanying attendance figures.

Power companies were quick to foresee the benefits of the cooking schools and lent their whole-hearted support. The free advertising which every one concerned received in the news columns of the papers sponsoring the schools would have cost thousands of dollars had a like amount of advertising space been bought. Much credit for the success of the undertaking is due Ray W. Turnball, Northwest district manager of the Edison Electric Appliance Company, who conducted the schools and was in charge of the entire program.

Southern California Edison Sets New-Business Bogey

THE Southern California Edison Company has set up 100,000 hp. as the minimum amount of new business to be obtained during 1923. To



ONE SESSION OF THE TACOMA "NEWS-TRIBUNE" ELECTRICAL COOKING SCHOOL

reach this mark the company has sixty salesmen in the field actively engaged in obtaining lighting, heating, cooking and power business. An electric range and water-heater campaign has just been launched, and a quota of 1,500 ranges and 500 water heaters has been established. Present indications are that the added business will far exceed the mark established as 30,000 hp. in additional load has already been signed up.

The company has been enjoying a steady growth in business for some time past, the territory served containing a rapidly increasing population. Many new homes are in course of construction, new industries are being started, and established plants are increasing their facilities. This, together with the intensive development work which the salesmen are doing, has enabled the company during the first two months to sign up almost one-third of the year's minimum quota.

Acquainting the Public with Utility Personnel

PERSONAL acquaintance of customers and the public with the members of a central-station organization is a valuable asset to the utility. To promote this idea the Utica (N. Y.) Gas & Electric Company recently displayed in its window an organization chart and photographs of its executives and its departmental groups which aroused much favorable comment in the community. As shown in the accompanying cut, the chart, which also is reproduced separately, was made the central feature of the display, and the line of authority and the functions of each individual or department were traced, beginning with the stockholder and terminating with the clerk or laborer.

Photographs of the executive officers, the "company council" made up of department heads, the superintendents' association, and group pictures of the staffs of the financial, operating, commercial, purchasing and suburban departments, together with a reproduction of an assemblage of more than a thousand people who attended the company picnic last summer, were included.

The chart and photographs, overtopped with a card bearing the caption "The Organization Back of Utica Gas & Electric Company's Service," were mounted on a background of copper-colored velvet, with a distinct headpiece or canopy of mulberry-colored velvet. Behind the canopy and concealed from the eye was an arrangement of several powerful incandescent lamps mounted in reflectors which illuminated the exhibit without glare, successfully overcoming the reflections and shadows from the buildings on the opposite side of the street. Incidentally, the Utica company retains the services of a professional window trimmer, who has charge of this work, and the displays are always of a high order.

Differently colored cords were arranged from the chart to the photographs of the executive departmental orzanizations, enabling the public to visualize the personnel of each department and its relation to the whole. It also made it possible for friends and acquaintances of individual employees to trace their connection with the company from this photograph back to the organization chart.

During the two weeks of the showing thousands of people inspected the exhibit and many complimentary remarks were passed on its originality and completeness. A number of business men and manufacturers expressed themselves as being so impressed with the display that they were going to prepare a similar one for their own companies.

The employees of the Utica company were thoroughly pleased by the public's interest, which was reflected to them through the medium of personal comment when they met with friends and acquaintances.

The company gained tremendously through the impression which it left with the individual, who visualized an organization of sufficient breadth

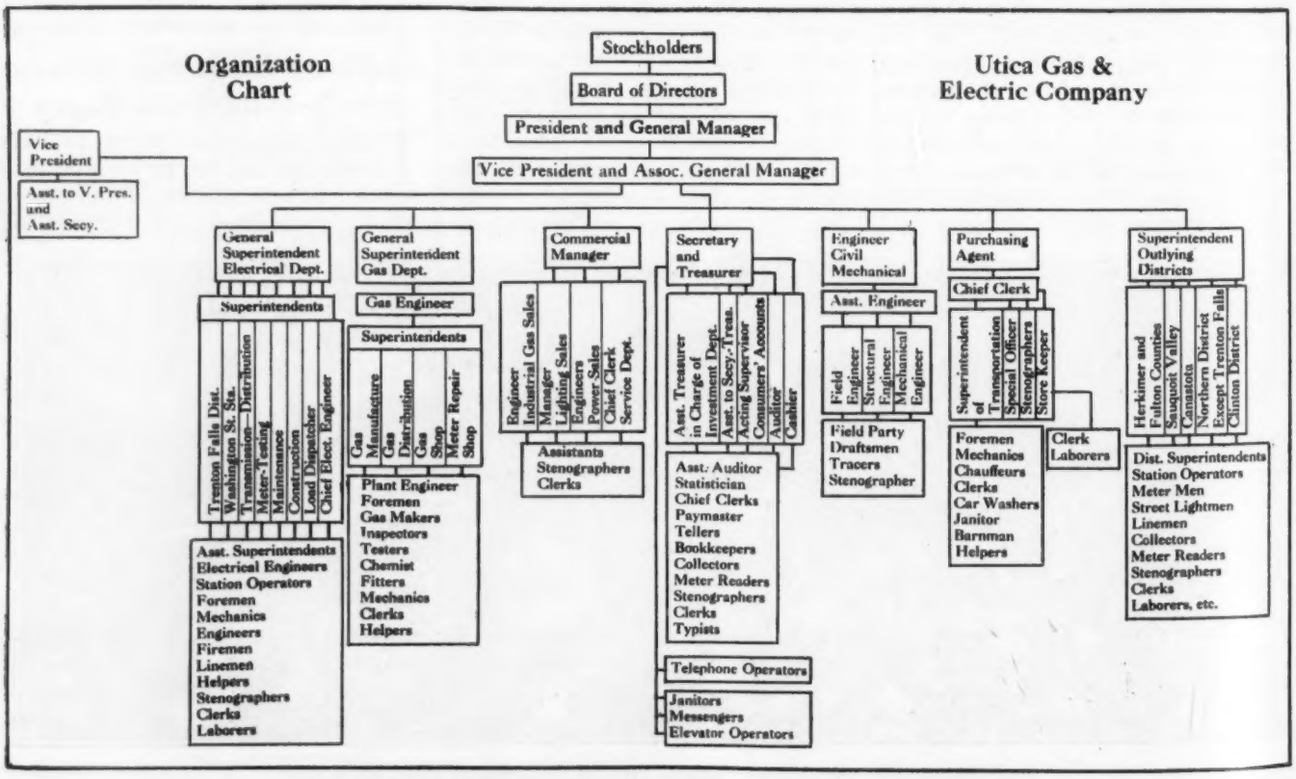
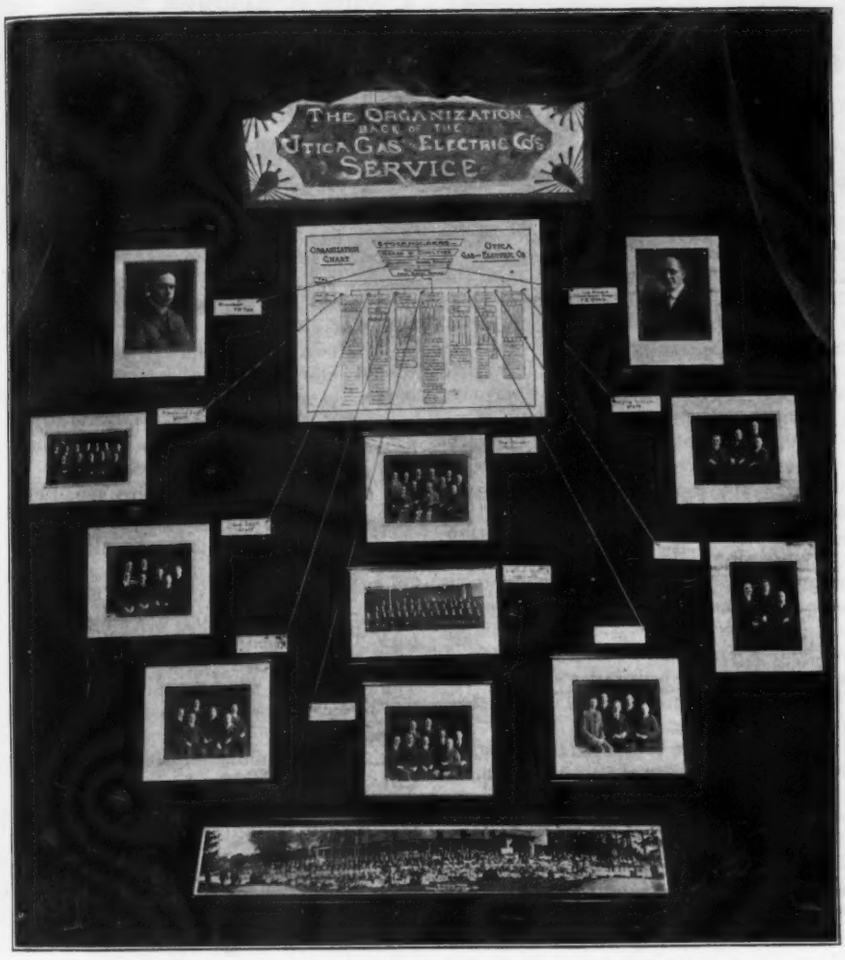


CHART SHOWING ORGANIZATION OF UTICA GAS & ELECTRIC COMPANY



WINDOW DISPLAY SHOWS COMPANY'S PERSONNEL AND ORGANIZATION

and scope, subdivided into departments all of which were necessary to give him an adequate and reliable service indispensable in his daily, commercial and home life. It also gave the public a clearer conception of the size of the staff and the number of high-grade men required to direct and carry on the company's work.

Maintaining a Permanent Sales Force

THE value of a permanent central-station selling organization was demonstrated in the number of new customers added to the lines of the Scranton (Pa.) Electric Company during the past year. In spite of the fact that the territory served by the company is the heart of the anthracite coal region which went through the depressing influence of a six months' coal strike, the company increased its electric customers from 39,000 to 44,000, or nearly 13 per cent.

E. W. Osborn, new-business manager of the Scranton Electric Company, states that this substantial increase under the prevailing conditions was possible because the company has developed a system of organizing and paying its sales force on a basis which encourages the salesmen to remain with the company. Nine salesmen are employed, who cover the entire territory, which is divided into districts. These salesmen handle all classes of business with the exception of industrial power, for which the company maintains a special department in charge of a power engineer.

Salesmen are paid on a salary plus commission basis, the salary starting at $80 per month and increasing $5 per month each year until it reaches $100. In addition to this, various commissions are paid. For a new residence customer 50 per cent of the first month's bill is paid as a commission and on store or commercial customers the commission is 25 per cent of the first month's bill. For successions—that is, where a customer moves out and another moves in—the commission is 10 per cent. On appliance sales a 5 per cent commission on the selling price up to $75 is allowed, and for appliances selling above that amount 3 per cent is allowed.

Under this method salesmen are able to earn from $2,000 to $3,000 annually, and it has enabled the company to build up a permanent sales force which accomplishes very satisfactory results from year to year. The company does not put on special selling campaigns, and appliances are sold on a cash or thirty-day basis, no deferred payment plans having been offered to customers.

What Other Companies Are Doing

Chicago, Ill.—For furthering the sale of stock the Public Service Company of Northern Illinois has printed an attractive folder, on which appear views of two main generating plants together with a map of northern Illinois, showing the territory served. One of the plants pictured is the contemplated 250,000-kw. station at Waukegan. Charts are also shown giving the yearly increases in gross business since 1912.

Minneapolis, Minn.—During 1922 the Northern States Power Company wired 7,407 old houses, which is 203 more than were wired in 1921 and about ten times the number wired ten years ago. According to H. E. Young, sales manager of the company, Minneapolis, with a population of 400,000, now has 99,000 homes, of which 80,000 are equipped for electricity. However, many of the 19,000 unwired houses will never be wired because their dilapidated condition requires that they be torn down and replaced by modern structures. During the past ten years the number of old houses wired in Minneapolis was 42,285.

Pawtucket, R. I. — An electric home will be established in April, 1923, under the auspices of the Blackstone Valley Gas & Electric Company and the central station, jobber and dealer interests identified with the Rhode Island Electrical League.

Brooklyn, N. Y.—Nine hundred and thirty-four employees of the Brooklyn Edison Company are enrolled in the co-operative courses which the company and the Brooklyn Polytechnic Institute are conducting. These employees represent 21.5 per cent of the personnel of the company. Seventy-one per cent of the employees in the secretary's department are listed for instruction, 57 per cent of one engineering department and 44 per cent of the sales department.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Modern Management Methods in the Power Plant.—B. ROBINSON.—The author discusses methods of analyzing power-plant performances and shows how to remedy defects in equipment. He also goes into detail on the importance of correct methods being used by the fireman.—*Industrial Management*, February, 1923.

Flow of Water in Turbine-Draft Tube.—O. MIYAGI.—An investigation of the water flow through draft tubes in which the water is conducted vertically downward to the tailrace. The author considers the energy lost by the frictional resistance in the draft tube and a sole plate, kinetic energy rejected at the end of the tube, the minimum loss and the determination of the best form of tube. He gives a numerical example illustrating his method.—*Technology Reports of the Tohoku Imperial University, Vol. III, No.* 1.

Feed-Water Deaëration. — The details of a closed feed-water system which has recently been designed and installed in a power plant by an English company for the complete deaëration of boiler-feed water is described. This system deaërates water only for supplying the boilers and economizers and their connections, and it is claimed that, as the operation is mechanical and automatic, the usual difficulties of adjustment have been entirely eliminated.—*Electrician*, Jan. 19, 1923.

Generation, Control and Switching

Safeguarding Workmen in Hydro-Electric Stations. — RALPH BROWN. — Proper protection of workmen in power plants jeopardizes not only the lives of those who are responsible for plant maintenance and operation but also the equipment and the service rendered by the plant. The author gives the details of a plan that has been adopted with a high degree of satisfaction for the protection of workmen and increased operating efficiency. Although this system has been worked out especially for a large hydro-electric station, it could be easily modified to apply to steam plants.—*Power*, Feb. 20, 1923.

Construction Details of Large Turbo-Generators—E. ROTH.—An elaborate practical paper, written primarily for designers of large steam-turbine-driven generators, showing the great advance made in this branch of engineering during the last ten years. While in 1913 a 7,500-kva. machine was built to run at 1,500 r.p.m., a modern 20,000-kva. set operates at 3,000 r.p.m. Rotor construction has undergone a great variety of changes until now the distributed field winding upon a core, built up of a few heavy steel disks, seems to be generally used for the largest units. Rotor bands for holding the winding, previously made of bronze, are now made of an unmagnetic steel, which gives greater strength. The testing speed of French generators is 10 per cent above normal running speed. As yet no uniform system of ventilation has been adopted, the author showing nine diagrams of systems being used at present. Internal-temperature measurement with thermocouples is advocated as the most reliable method. In two-pole machines a momentary short-circuit current of thirty times normal may be expected. Very high testing voltages insure a reliable operation in service. The recently built 45,000-kva. generators for Gennevilliers, designed for 6,000 volts, have been submitted successfully to an 18,000-volt, one-minute test. The rotor windings should stand ten times normal voltage. A circumferential rotor speed of 130 m. per second seems to be about the limit for the present. The paper is illustrated with thirty-six valuable photographs. — *Revue Générale de l'Electricité*, Jan. 27, 1923.

Transmission, Substations and Distribution

Wave Form and Power Factor of Mercury-Arc Rectifiers. — H. JUNGMICHL. — This highly mathematical paper develops the primary wave form for customary transformer connections of rectifiers and proves the results by means of oscillograms. The formulas hold true only for anode and direct-current circuits free of inductance and neglect stray fields of the transformer. The influence of the magnetizing current upon the wave form is shown on oscillograms. From the form of the primary current wave the author calculates the power factor, differentiating between the power factor in the winding and that of the feeder. It is also shown how the power factor may be calculated for two three-phase rectifiers operating in parallel six-phase connection. — *Elektrotechnik und Maschinenbau*, Jan. 21, 1923.

Safe and Economical Ways of Hanging Electric Cables in Mine Shafts.—F. W. CRAMER.—It is essential to efficiency that the electric cables in mines be properly designed and installed. If they are so planned and erected, they may be forgotten with safety, but if haphazard construction and the wrong cable is used, the feeder system may be a source of continuous trouble. One danger is the stretching of the copper cable, thereby lowering its capacity. Protecting lashing, cable clamps and cable supports which bend the cable into desired shapes are among the subjects discussed.—*Coal Age*, Feb. 15, 1923.

Units, Measurements and Instruments

Resistivity of Vitreous Materials.—L. L. HOLLADAY.—The writer has investigated the resistivity of various types of glasses and has found that all results seemed to follow a general law which had not been heretofore generally recognized. Eleven specimens of glass were tested through a temperature range of 20 deg. to 500 deg. C., the results being plotted.—*Journal of the Franklin Institute*, February, 1923.

Test Code for Instruments and Apparatus.—The A. S. M. E. committee on power test codes is now engaged in the revision of the codes as issued in 1915. The preliminary drafts of Chapters 1 and 2 are given. These deal respectively with general considerations and with the accuracy of measuring instruments. The instruments and apparatus here considered are those used for measuring physical and chemical quantities in connection with tests of power equipment of various sorts.—*Mechanical Engineering*, February, 1923.

Water Rheostat for 30,000 *Volts.*— J. REYVAL.—A new 1,900 kva. single-phase generator was added to a French hydro-electric power house, and it was found desirable to make full-load tests of this new machine after it was installed. As the voltage of the generator was only 850, it would have been necessary to provide a rheostat heavy enough to carry as much as 1,500 amp., which was not deemed advisable. It was decided to connect the generator to its step-up transformer (850 volts to 30,000 volts) and to build a water rheostat to consume a current of some 40 amp. at about 30,000 volts. The electrodes were made of heavy steel plates 1 m. square, placed on insulators across the tailrace water, 2.4 m. apart, and were so arranged as to lower or raise them.—*Revue Générale de l'Electricité*, Jan. 20, 1923.

Illumination

Illuminating Engineering Society Papers.—This issue of the *Transactions* contains three papers presented at the Swampscott convention last September. They are "The Cost of Daylight," by M. Luckiesh and L. L. Holladay; "Lighting for Motion-Picture Studios," by F. S. Mills, and "Flicker Photometry," by C. E. Ferree and G. Rand. Abstracts of the first two may be found in the convention report, ELECTRICAL WORLD, Oct. 7, 1922, page 760, and of the latter in the ELECTRICAL WORLD for Nov. 4, 1922, page 1004. The complete discussion of the three papers is also given in the *Transactions.*—*Transactions of the I. E. S.*, February, 1923.

A Highly Developed Engine-house Lighting System.—The wiring system of the New York Central engine house at Solvay, near Syracuse, N. Y., distributes power for motors, for motor-generator welding sets and for lighting purposes that really furnishes enough light and distributes it where it is needed without glare. A sufficient number of switches of a rugged type also make it convenient to burn only the lights that are needed. A description of the lighting system is given, illustrated with layout diagrams and photographs of typical points of interest, such as distribution panels, engine switches, control equipment for lighting equipment, etc.—*Railway Electrical Engineer*, February, 1923.

Motors and Control

Electricity as Applied to Mines.—J. C. STEWART.—The types of generators, motors and cables used in collieries are explained and the factors governing the use of each particular type are discussed. A brief outline of the mechanical plant used in conjunction with motors is given, including pumps, haulages, coal cutters and winders.—*Journal of the Institution of (British) Electrical Engineers*, January, 1923.

Electricity in the Chemical Industries.—The use of electric drive in the chemical industry involves very severe operating conditions for the motors. Very often the atmospheric conditions are damp and corrosive, and with water, steam and gases present in abundance it sometimes appears that electric drive would involve heavy maintenance charges. However, modern electrical development has surmounted these inherent difficulties. Winding and control gear are protected, and with this provision it is possible to use apparatus that is otherwise standard. In discussing this problem, the author considers the handling of liquors, pumps, uses of compressed air, handling of solids, crushing operations, etc. —*Electrical News*, Feb. 1, 1923.

Electrical Equipment for Grain Elevator.—J. ANDREUCETTI.—When rebuilding the Chicago and Northwestern grain elevator at Chicago it was found necessary to renew a considerable portion of the electrical apparatus. The apparatus now consists of dust-proof distribution panel cabinets and vapor-proof lighting units with all new conduits and wiring run in such a manner as to insure reliable and safe operation. In this plant there are 190 motors in all, varying from 1.5 hp. to 140 hp., totaling 8,027 hp.—*Railway Electrical Engineer*, February, 1923.

Heat Application and Material Handling

Electric Heat Storage Stoves.—Where electric energy is cheaply available during off-peak hours, as in most small-size hydro-electric plants, the use is suggested of electrically heated stoves, which are charged during the night hours and discharged during the day. Fully charged the oven reaches an outside temperature of about 100 deg. C. As a rule a complete cycle of eight hours' charging and sixteen hours' discharging is recommended. During this cycle the stove temperature will vary from 30 deg. to 100 deg., while the room will be kept between 20 deg. and 25 deg. C. The stoves are made in five sizes from 3-kw. to 15-kw. capacity, sufficient for rooms of 4,000 cu.m. to 100,000 cu.m. — *Siemens Zeitschrift*, January, 1923.

Coal Handling by Suction.—The installation of an interesting pneumatic coal-handling equipment has recently been completed at the Brimsdown (England) power station of the North Metropolitan Electric Power Supply Company. The equipment performs three distinct handling operations by means of one receiver and vacuum pump. Coal can be discharged from barges lying in an arm of the canal alongside the station at the rate of 50 tons per hour, or by means of a simple linking up of piping coal can be taken from the dumps and conveyed to the bunkers. Provision has been made for withdrawing coal from a tipping hopper below a railway track by operation of change-over valves adjacent to the receiver. A description, illustrated by diagrams, is given of this installation. —*Electrical Times*, Feb. 15, 1923.

Traction

Electrification of the Hungarian Railways.—L. VEREBELY.—The planned electrification of 1,385 km. of the railroads of Hungary is expected to result in a 60 per cent coal saving over present conditions. No definite system has, as yet, been decided upon, but an agreement has been reached between the Hungarian government and the Hungarian firm of Ganz to test one of the latter's split-phase locomotives on part of a main road. The locomotive will be properly equipped for a thorough test of one year. The overhead wire of the test stretch of 15 km. carries 50-cycle, 15,000-volt, single-phase current, from which is fed a phase converter on the engine delivering 420-volt to 750-volt, three-phase current to the locomotive motors. On the locomotive, installed at half height, are two motors of 1,360 hp. each, with a double winding on both the stator and the rotor, giving four economical speeds. Triangular connecting rods transmit the motor power over a blind shaft to the five driving axles. The locomotive weighs complete 72 tons.—*Elektrotechnik und Maschinenbau*, Jan. 14, 1923.

Electric Haulage for Mines.—A. F. Brosky.—One of the troubles most often encountered in mine railway systems is the derailment of locomotives and cars. Wearing down of locomotive tires is the most frequent cause of derailment. Reports received from several mechanical engineers at mines indicate that they are practically unanimous in the belief that a locomotive should never be allowed to become more than an inch lower by wearing of the wheels. Several of the other causes for derailment are also discussed.—*Coal Age*, Feb. 8, 1923.

Electrochemistry, Electrophysics and Batteries

Copper. — The Bureau of Standards plans to issue from time to time circulars on individual metals or alloys, with the idea of grouping in these circulars all the information which the bureau has as a result of its tests and investigations, together with that available in all records of published tests and investigations of such materials. This circular on copper deals primarily with the physical properties of the metal. All of the factors, except a few statistics of production, such as methods of manufacture, presence of impurities, etc., are discussed only in their relation to these physical properties. The data and information have been put in the form of tables and curves, the curves being reproduced in such dimensions that accurate interpolation of the values on them is possible by the use of a rule graduated in decimal parts of a centimeter.—*Circular No. 73 of the Bureau of Standards.*

Telegraphy, Telephony, Radio and Signals

Control of High-Frequency Current with Iron-Core Choke Coils and Superimposed Direct Current.—L. PUNGS.—The necessity of easy control of large amounts of alternating currents of high frequency for radio-telephonic and radio-telegraphic use is discussed. By means of an iron-core choke coil with two windings, one for the high-frequency current and the second carrying direct current, the former can be easily controlled by variations of the latter. The paper gives several connection diagrams for the application of this method for radio telephony. — *Elektrotechnische Zeitschrift*, Jan. 25, 1923.

Alternating-Current Cable Telegraphy.—LOUIS COHEN.—The author discusses the so-called arrival curves for an impressed sinusoidal electromotive force on a cable with and without terminal apparatus and then compares his results with those of former investigators on the subject. The paper is limited to a consideration of fundamental principles.—*Journal of the Franklin Institute*, February, 1923.

Miscellaneous

The Structure of Carbon Steels.—H. S. RAWDON and S. EPSTEIN.—A study of the microstructure of hardened and tempered carbon steels has been carried out on a series of six steels ranging from 0.07 and 1.12 per cent carbon. These were hardened by water-quenching from different temperatures ranging from 750 deg. to 1,250 deg. C. The investigation consisted largely of microscopic examination, supplemented by a study of the scleroscope hardness of the quenched and of the tempered steels.—*Journal of the Franklin Institute*, February, 1923.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

New York Water-Power Regulation

Attempt of the Governor to Commit State to a Policy of Government Ownership and Operation Is Not Likely to Meet Success

GOVERNOR SMITH'S program for the State of New York to own and develop its water-power resources and to distribute hydro-electric energy to municipalities has met with such opposition in the Assembly that its passage at this session of the Legislature is unlikely.

The eyes of the Governor are fastened on the Niagara and St. Lawrence Rivers, both of which possess magnificent hydro-electric possibilities and both of which are international boundary and navigable streams over which the federal government exercises control.

At present there is an international treaty governing the diversion of water for power and other purposes above the falls at Niagara Falls, and an attempt has been made to draft another treaty between Canada and the United States with reference to the further canalization of the St. Lawrence River and the erection of dams for that and power purposes on the river.

A survey has been made by the International Joint Commission, which has submitted a report and recommendations to both Washington and Ottawa; but no action has been taken by either government. There is also a suit pending before the United States Supreme Court in which the State of New York questions the constitutionality of the federal water-power law and the right of the federal government to control the water powers in the boundary and navigable streams in the State of New York. A decision in this case is expected shortly.

The Existing Law

During the administration of Governor Miller a law patterned after the federal water-power law was enacted in New York. Under this law a water-power commission of the state grants licenses for water-power development for a period of fifty years. A fee is charged and preference is given to the applicant whose plans are best adapted properly to develop, conserve and utilize the water power of the locality.

It was the contention of Governor Miller at the time that regulated private development was preferable to state or municipal development, and he advocated the adoption of a policy which would make it practicable for private initiative to undertake the task under safeguards which would protect the public interest. Governor Smith, in fulfillment of election pledges and the platform of the Democratic party, now seeks to set aside that legislation.

Outside of the Barge Canal, the Niagara and the St. Lawrence Rivers, the two latter being involved in litigation, there are few choice water-power sites available. There is a possibility of further development on the feeders and upper reaches of the Hudson River, but the sites are all owned by paper mills and power companies. Moreover, before these water powers can be developed it will be necessary to obtain the sanction of the proper river-regulating commission.

River Regulation

River regulation is an established policy of the state and serves a double purpose. By the construction of dams and reservoirs seasonal floods are held in restraint and control. In addition, these dams and reservoirs permit the proper development of the hydro-electric power in the streams involved. Under the river-regulating law the state can condemn property for the construction of dams. River-regulating districts are mapped out and the cost of improvements is assessed upon the property benefited. The boards are required by law to prepare a statement of the amount of water power, if any, which, consistently with the proper regulation of the flow of the river, may be developed by the withdrawal of water for power purposes.

The Black River Commission is now constructing dams on the Black River on the petition of water-power owners who will bear the expense. Last year a similar commission was appointed for the Upper Hudson on the request of the cities of Albany and Troy and others which seek to be relieved of the menace of floods. There is no indication that the Governor seeks to wipe out these commissions.

Bringing Power to New York City

Chief talk in political circles centers on bringing Niagara or St. Lawrence River power to New York City and on developing the Delaware River. The latter stream rises in New York State and for a distance forms the boundary between New York and Pennsylvania and between Pennsylvania and New Jersey. The Delaware River is navigable from the ocean to Trenton, N. J., but the rights on part of it are tied up by grants antedating the Constitution of the United States. New York is seeking to come to an understanding with the other two states over the river by means of a tri-state treaty. New Jersey has already passed enabling legislation, but the other two states have not yet acted. The plan published by New York calls for the use of the water of the Delaware chiefly for drinking and sanitary purposes in New York City. If the water is to be consumed, there will be little left for water-power development or for navigation, and a pretty legal battle is sure to ensue.

As for bringing Niagara or St. Lawrence River power to New York, the dream of cheap power is likely to remain a dream and nothing more. It is, of course, feasible to transmit electricity for this distance, or any distance for that matter, if no regard is to be given to cost or to reliability of service. There are those who contend that it is cheaper to develop electricity in steam stations and that even if hydro-electricity were transmitted to New York City in bulk, steam stations would still be necessary, with the result that costs would be higher instead of lower. It probably would be necessary to make the installation, however, before the contentions made on either side of the controversy could be proved. Meanwhile the large electric light and power companies in the affected district continue to build huge steam-driven central stations, which would indicate that they do not regard the proposed transmission of hydro-electric energy as menacing their investment.

Up-State Enthusiasts

On the other hand, persons who are enthusiastic over the prospect of developing the boundary streams rob the politicians of their thunder by claiming that the power would be absorbed by up-state industries and cities and that there would be none left for the metropolis. This, they contended, is a better use for the power since it helps to spread industry over the state and makes for better living, transportation and industrial conditions. In no case, however, has any evidence been provided which would show that private

enterprise is not willing and competent to undertake the work of developing the water powers of the state with better results and better service than could be obtained under state ownership and operation. These are the arguments which have been put before the legislators at Albany. The financial menace of state development has also been brought to their attention, and at present the line-up is such that the Governor's program is blocked.

Hydro Power for New York City

Engineers Discuss Relative Advantages of Steam and Hydro-Electric Service and Availability of Niagara and St. Lawrence Power for Long-Distance Use

BEFORE a well-attended joint meeting of the metropolitan sections of the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers held in New York on Wednesday evening, the availability of hydro-electric power for the New York-New Jersey metropolitan district was discussed at length. Calvert Townley presided, and F. W. Scheidenhelm, a consulting hydraulic engineer, made the co-ordinating statement of the problem.

An approximate estimate of the available water power in the Hudson, Delaware and Susquehanna Rivers was given by W. S. Murray, who also gave the power requirements of the district and the probable cost of delivering Niagara power to New York and St. Lawrence power to New England. Much of the information was obtained from studies made in connection with the Superpower Survey of the United States Geological Survey and from subsequent surveys. Mr. Murray pointed out that steam stations would have to continue to generate the bulk of the power required in the district and that with every water power in the section developed hydro-electric energy would be available for only one-third of the load. He told of superpower stations erected since the government report was published and paid a tribute to the efficiency of electric light and power production by central stations.

SERVICE REQUIREMENTS OF NEW YORK

George A. Orrok of the New York Edison Company painted an impressive picture of the service requirements of the metropolis and of the precautions taken to keep the community supplied with energy at any and all times and under all sorts of conditions. He referred to the enormous loads which are thrown on the New York Edison system, sometimes for only a few moments, in the daytime owing to sudden storms and squalls. On Feb. 28, when New York City was shrouded by a London fog, the normal load of 120,000 kw. increased to 435,000 kw. in two and a half hours and remained at approximately that value for eight hours. Mr. Orrok showed how vital continuous service is to the city and intimated that a block of hydro-electric power could be absorbed in New York if the price was right.

The next two speakers, F. A. Allner of the Pennsylvania Water & Power Company of Baltimore and Lorin E. Imlay of the Niagara Falls Power Company, told of the early troubles of hydro-electric and transmission systems and showed how with experience and advances in the art reliability in generation and transmission has been secured. Mr. Allner's Holtwood station in the Susquehanna River supplies electricity to Lancaster, Pa., and to Baltimore, being operated in conjunction with huge steam stations in the latter city. He showed how the stations are operated to best advantage and how during periods of low water the peaks are carried by the hydro station and during periods of high water the procedure is reversed.

Mr. Imlay reviewed the operations of the Niagara, Lockport & Ontario system and predicted the exhaustion of nearby coal fields in the near future, intimating that hydro-electric power would have to be relied on more and more by the industries of the state.

Contributions to the discussion were made by John P. Hogan, a consulting engineer of New York, and W. S. Finlay, Jr., vice-president of the American Water Works & Electric Company. The latter compared the service in the metropolitan district with that obtainable elsewhere and contended that such excellent service must of necessity be costly. He doubted whether inferior service at cheaper cost would be acceptable and said the issue would have to be decided before long. The district could absorb considerable hydro-electric power of right quality and price. One of the speakers suggested that by means of interconnections it might be possible and profitable for the steam stations of New York to sell supplementary power to nearby hydro-electric systems.

Asks $710,000 for Vischer's Ferry and Crescent Dam

In a special message to the Legislature asking for the appropriation of $710,000 to finish the state water-power development on the Barge Canal at Crescent Dam and Vischer's Ferry, on which $1,000,000 has already been expended, Governor Smith of New York suggests that the law be amended to permit the Superintendent of Public Works, the State Engineer and the Attorney-General to negotiate with the municipalities in the capital district, where the plants are, for delivery to them of this power at cost for ultimate sale to consumers. He also suggests that, inasmuch as engineers estimate that power from these plants will be available only 60 per cent of the time, these municipalities might be asked to generate auxiliary power themselves, or possibly the state might do so, in order to have available at all times sufficient firm power to meet the requirements of users in the capital district.

The plant at Crescent Dam is completed with the exception of the tailrace and contains two units capable of developing 8,000 hp. At Vischer's Ferry, where it is the intention to install similar equipment, the two plants to be run as one, only the foundation has been laid.

Governor Smith Retreats

He Now Says that "Interstate Exchange of Electrical Energy" Is "Probably Not Far Off"

IN ANSWER to the letter from Governor Pinchot of Pennsylvania asking him to discontinue the suit brought in the name of New York State against the Federal Power Commission and pointing out the impolicy and impracticability of New York's attempting to confine the use of her water power within the state borders (see ELECTRICAL WORLD, March 17, page 646), Governor Smith of New York, while maintaining his determination to contest federal control of the water powers on the navigable rivers of the state, goes on to say:

"I agree with you that the time is probably not far off when there will be an interstate exchange of electrical energy, in which event, of course, the State of New York would be one unit. Nothing contained in or contemplated by the state's suit to test the constitutionality of the federal water power act need interfere with the eventual accomplishment of that purpose. The State of New York may ultimately determine that the people of the State of Pennsylvania, or for that matter of any other state, would be considered in the distribution of electrical energy. When that happens, however, with New York's property it should be done by New York and not by the federal government. We need no federal assistance to promote useful helpfulness and consideration between the states."

This utterance indicates a marked modification of the opinion expressed by Governor Smith in the message on water power sent by him to the New York State Legislature, when he said:

"The bed of our streams over which power-creating water flows belongs to the state, or, better still, to its citizens. Our use and control of the same is threatened. I am credibly advised that a strong and determined propaganda is now being spread in support of a plan to divert the electrical energy from our border streams to territory outside the state. This we must resist with all the power that we can bring to our command."

Conference Discusses Radio Chaos

Organized Co-operation Imperative in Face of Lack of Legislation—Reallocation of Wave Bands to Alleviate Interference Is Favored—Recommendations of Radio Inspectors

A CONFERENCE called by Secretary of Commerce Hoover to consider the chaotic condition in which radio transmission has been left by the failure of Congress to take action was held in Washington on Tuesday and Wednesday of this week. In opening the meeting Secretary Hoover offered to suggest to the President that the wave length reserved to the government (600 m. to 1,600 m.) be opened to broadcasting, at least in the lower part of its range. Since the last conference, one year ago, he said, the number of broadcasting stations has increased from 60 to 588 and the number of receiving stations has more than doubled and now is somewhere between one and a half and two and a half millions. He called for organized co-operation to meet the emergency.

Virtually all who participated in the conference recognized the paramount interest of the public and favored a reallocation of wave bands. Maintenance of wave lengths by transmitting stations was declared imperative.

Discussion on Broadcasting

Gen. G. O. Squier, U. S. A., saw no reason why the government's reserved wave lengths could not be thrown open and expressed faith in co-operation stimulated by the Secretary of Commerce. Commander D. C. Bingham, U. S. N., said the needs of ships and aircraft must not be overlooked. Civic bodies must, he said, co-operate, for there are not enough practicable wave bands for all. Dr. A. N. Goldsmith, secretary of the Institute of Radio Engineers, thought that economic reasons would cause the discontinuance of high-class broadcasting unless it can be protected. Hiram Percy Maxim of the American Radio League suggested the exclusion of advertising. C. B. Cooper favored regulating schedules rather than wave lengths. E. H. Armstrong, Columbia University, announced that if proper wave bands can be allocated apparatus which can receive from any station in the land will be ready in a year or two.

Two suggestions that met with considerable approval were made by J. V. L. Hogan, consulting engineer. Because of the relative number of channels available above and below 600 m., he contended, the higher-frequency range should be allotted to telegraphy and the lower range to telephony. To make policing stations unnecessary, he suggested that recording wave-length meters be required in every transmitting station.

F. P. Guthrie, United States Shipping Board, promised co-operation, and representatives of the Post Office, Agricultural and Treasury Departments expressed their warm interest in the subject. Leo Fitzpatrick, speaking for the newspapers, thought the government radio inspectors would form a good nucleus of a force to alleviate interference. J. H. Dellinger, Bureau of Standards, spoke of the increasing use both of electron-tube oscillators and of shorter wave lengths as important factors.

A recommendation covering an allocation of wave lengths between 150 m. and 3,850 m., prepared by a committee of radio inspectors, acting at the instance of Mr. Hoover, was submitted by W. D. Terrell, their chief. The allocations were based on the existence of 22,740 transmitting stations.

"Heretofore," said the report, "the broadcasting service has been limited to the specific wave lengths of 360, 400, and 485 m. The committee has provided six bands of wave lengths for the broadcasting service (320, 380, 390, 430, 675, 725 m.), two of which are within the government reservation. This arrangement will permit the reception of signals from several stations operating simultaneously in close proximity with the minimum interference possible under our present limitations, provided receiving apparatus of reasonable selectivity is employed and adjusted efficiently."

Mr. Terrell thought an expensive policing system necessary to the maintenance of wave lengths. Paul Godley urged allowing amateurs shorter wave lengths, and K. B. Warner outlined the field organization they have already achieved in a voluntary effort to avoid interference.

Other experts discussed the transmission of motion pictures, told of successful voluntary co-operation of eighteen broadcasting stations near San Francisco, and described the successful staggering of wave bands according to the nature of the program and the location of the station.

Ship interference caused much animadversion. It was said to reach even to the Middle West. One speaker urged that ships be compelled to substitute continuous-wave sets for spark sets.

Public Hearing Backs Conferees

At a public hearing on Wednesday stress was laid on the same points emphasized previously by the members of the conference and the inspectors. A representative of the General Electric Company, Mr. Edwards, said its broadcasting, rated at from 1½ kw. to 2 kw. at 400 m., is received regularly in Hawaii and had been picked up on the west coast of Panama; E. F. W. Alexanderson said that the Radio Corporation desired three wave bands—transatlantic, ship-to-shore and for broadcasting; R. A. Weagant urged high-power stations on special wave bands for long-distance broadcasting; C. N. Jansky described co-operative methods in Minneapolis and St. Paul, and Allen M. Perry, engineering editor ELECTRICAL WORLD, suggested gathering through the newspapers public opinion on what kind of broadcasting is objectionable.

Simultaneous sending at 360 m. and 400 m. was discussed. A representative of the Society of American Composers and Authors dwelt on the copyright complication that arises in broadcasting music and said legal proceedings might be necessary to protect composers. The Federal Telephone & Telegraph Company, Buffalo, requested a wave length of 300 m. to 500 m. for broadcasting, but urged the elimination of harmonics in this band. Strenuous objection was raised to interspersing other than broadcasting wave bands between broadcasting frequencies. Amateurs should not be limited further, it was contended, but the transmission equipment should be limited in character for wave lengths above 200 m.

New Peoria Plant with Initial Rating of 53,300 Hp.

The Illinois Electric Power Company, a subsidiary of the Commonwealth Power Corporation, has acquired property rights in a site on the Illinois River opposite Peoria, Ill., and will immediately begin the construction of a generating station with an initial rating of 53,300 hp. and an ultimate capacity of 133,000 hp. The company will also construct more than 65 miles of 120,000-volt transmission lines connecting with the distributing system of the Central Illinois Light Company at Peoria and with that of the Illinois Power Company at Springfield, thus forming a physical interconnection of these three properties. With the added capacity of the new station, the combined companies will have a generating capacity of more than 102,000 hp.

New England Power's Program to Cost $3,000,000

Construction work to cost in the vicinity of $3,000,000 is planned by the New England Power Company, Worcester, Mass., in the near future. The company has petitioned the Massachusetts Department of Public Utilities for the right to issue 30,000 shares of common stock at $100 per share to cover the following prospective outlays, grouped under "Davis Bridge," "Pittsfield" and "miscellaneous": Davis Bridge—Two-circuit, 110,000-volt line to Millbury, Mass., $1,890,182; extension of Millbury substation, $240,600; synchronous condenser, 10,000 kva., for Millbury, $107,455; improvements at No. 5 station near Hoosac Tunnel, 70,000-volt bus structure, $75,850. Pittsfield—24-mile, 66,000-volt line to Massachusetts-New York state line, $259,200; Lanesboro substation, $130,000; increased capacity Adams substation, $40,000; second circuit Davis Bridge to No. 5 station, $41,000; additional equipment for this circuit, $30,000. Miscellaneous—Additional transformer capacity, Fitchburg and Ware, Mass., $123,300; 22,000-volt line, Ware to Otis Mills, $12,000; Otis Mills substation, $24,400; sundry expenses, $240,785.

A. I. E. E. Nominations

"Directors' Nominees" Selected—Prof. Harris J. Ryan of Stanford for President

AT THE meeting of the board of directors of the American Institute of Electrical Engineers held in New York on March 16 the report of the committee of tellers on its canvass of the nomination ballots cast for candidates for the Institute offices falling vacant July 31, 1923, was presented.

As required by the constitution of the Institute, the board then selected by ballot its list of "directors' nominees," with the following result:

For president—Harris J. Ryan, Stanford University, Cal.

For vice-presidents—District No. 2 (Middle Eastern), William F. James, Philadelphia; district No. 4 (Southern), H. E. Bussey, Atlanta; district No. 6 (North Central), Herbert S. Sands, Denver; district No. 8 (Pacific), J. E. Macdonald, Los Angeles; district No. 10 (Canada), S. E. M. Henderson, Toronto.

For managers—H. P. Charlesworth, New York; William M. McConahey, Pittsburgh; W. K. Vanderpoel, Newark, N. J.

For treasurer—George A. Hamilton, Elizabeth, N. J.

The election ballots, including the names of the directors' nominees and all other eligible candidates, will be mailed to the membership prior to April 1.

New British Specification for Motors and Generators

The British Engineering Standards Association has just issued a publication, No. 168-1923, giving the British standard specification for electrical performance of industrial electric motors and generators with class A insulation. This publication is the action resulting in Great Britain from the recent meeting of the advisory committee on ratings of the International Electrotechnical Commission in Geneva, when a 40-deg. rating with a two-hour 25 per cent overload was authorized for certain classes of industrial motors in addition to the former I. E. C. standard of 50 deg. continuous.

As noted in the letter of transmittal from C. le Maistre, secretary of the association, the specification applies to industrial electric motors and generators for 1 b.hp., 1 kw. or 1 kva. and upward per 1,000 r.p.m., having windings insulated with class A material (impregnated cotton, paper or silk), wound for voltages not exceeding 7,000 and having either a continuous or a short-time rating.

In the words of the secretary: "Stated briefly, the new British standard rating is: Temperature rise (on rated load), 40 deg. C.; temperature rise for totally inclosed machines and machines with short-time ratings, 50 deg. C.; dielectric test, 1,000 volts plus twice rated voltage; momentary overload, short-time-rated machines, 100 per cent for thirty seconds; momentary overload, continuous-rated machines, 50 per cent for five seconds; sustained overloads, short-time ratings and all totally inclosed machines, none; sustained overloads, continuous rating, 25 per cent for two hours except for small machines. No provision is made for tests of temperature rise after the sustained overloads."

The entire specification is quite complete and detailed. It is the first of a series designed to supersede the British "Standardization Rules for Electrical Machinery" (Publication No. 72-1917).

To Expand Tests on Insulating Materials

At a meeting of the committee on insulating materials of the American Society for Testing Materials held in New York last week three new tentative standards were considered for submission to the society in June. These include a method of testing insulating materials for puncture and flashover voltages at radio frequency, a method of testing electrical insulating materials for thermo conductivity, and methods of test for pothead and splicing compounds. Details of these standards will be available in reprint form for advance study by the first of May.

It was agreed to expand the existing tentative method of testing sheet insulating materials for dielectric strength to include cambric tape, a procedure for tapes having been devised. There will be added to the existing methods of testing insulating varnishes a non-volatile matter test, a draining test (working viscosity) and an evaporation test. The existing method of test for power factor and dielectric constant of molded insulating materials at radio frequencies will be expanded to take care of sheet materials and compounds.

An extensive discussion was had of the results of the long investigation of four methods of determining the sludge-forming propensities of transformer oils and a final recommendation to the society was agreed upon. It was agreed that the annual report should include a quite extensive discussion of this subject. It was also agreed that the annual report should include as an appendix a convenient and accurate method of testing insulating materials for power factor and dielectric constant at normal commercial frequencies which has been brought to the attention of the committee. It is particularly suited to tests of liquid insulations and compounds over a wide range of temperatures.

The annual report is also to include an appendix describing a new method for determining the relative rate of deterioration of transformer oils. The results of an investigation of the effect of the rate of application of potential on the apparent dielectric strength of insulating materials will also be included in the report.

To Cross the Sierras

California and Nevada Companies to Be Connected by a Transmontane Transmission Line

AN AGREEMENT between the Pacific Gas & Electric Company of San Francisco and the Truckee River General Electric Company of Reno, Nev., for the construction of a transmission line over the Sierra Nevada Mountains has recently been reached, according to E. W. Florence, manager of the Sacramento division of the first-named company. The Truckee General Electric Company serves a mining load in the Comstock district, and the revival of mining there has greatly increased the demand made upon the company.

To meet this increased demand arrangements have been made for the Pacific Gas & Electric Company to supply additional power to the Nevada company. A line will be constructed from the Drum power house on Bear River, near Towle, Cal., over the summit of the Sierra Nevada Mountains and will connect with the lines of the Truckee company at Verdi, Nev. The construction of the lines over the mountains will have to be of extremely rugged construction because of the heavy snows in the region, the snow often reaching a depth of from 5 ft. to 20 ft. The lines of the Truckee company will have to be increased in size in order to care for the larger load that will be handled by the company. The Truckee General Electric Company now serves the cities of Reno, Carson and Virginia City and the surrounding territory.

Providence Company to Build 125,000-Kva. Switch House

On March 8 the Narragansett Electric Lighting Company sustained an interruption of service during the early morning hours on account of short circuits in cable and switch equipment at the South Street generating station.

For more than a year the company has been studying the development of its cable and switch-handling equipment. The accident has given increased impetus to its plans, and a switch house embodying the latest ideas in isolated-phase design will soon be built. It is hoped to have the new installation completed inside of twelve months. Dwight P. Robinson & Company, New York, have been planning this development for the Narragansett company, and engineers of the General Electric and Westinghouse companies have also been in consultation. During the interim before the new switch house can be placed in service temporary changes will be effected along the line of greater separation of existing cables, the installation of fireproof barriers in the more congested sections, the division of the cable vault into two sections at South Street and the placing of various disconnecting switches outdoors.

Appliances Lose Ground

Southwest Division Men Hear Opinion to This Effect—Good Commercial and Technical Sessions

THAT the appliance industry is steadily losing ground in relation to its sales possibilities in the electrified home was the assertion made by Martin L. Pierce, promotion and research manager of the Hoover Company, North Canton, Ohio, in discussing the potential market for electric appliances before the March 16 meeting of the convention of the Southwestern Geographic Division of the National Electric Light Association at Oklahoma City, of which the opening session was reported last week. If the rate of increase in electrical appliances and the increase in wired homes during 1921 and 1922 continue for the next ten years, he said that only 20 per cent of the electrified homes will have electric cleaners, as compared with the present 40 per cent, and that the same statement applies to all appliances.

Mr. Pierce recommended settlement on a standard-cost basis of doing business such as other lines of industry have adopted and a merchandising campaign that will last twelve months of the year. Standardization of electrical appliances, elimination of poor equipment and standardization of trade discounts were urged.

A. K. Baylor told of the work of the Joint Committee on Business Development, and a committee was appointed to take up the work of organizing the various branches of the electrical industry in the five states of the division for business development work.

Organization of employees' clubs is not a charitable undertaking into which a company must put a great deal of expense, J. H. Gill said, in presenting the report of the committee dealing with employee organizations. Such organizations are more successful if self-supporting and managed by employees themselves. The committee presented a model form of organization for such clubs.

E. W. Hodges, manager of the Arkansas Utility Information Bureau, made a plea for greater service in building up the community and said that while utilities have always been community builders, they have many times gained the reputation of being "hard-boiled" because they have not told their stories properly and shown their community the place they occupy in its welfare. He advocated reaching every class of citizens personally with utility facts.

COMMERCIAL SECTION

In the Commercial Section meetings the problem of ice-plant loads was the subject of a discussion led by R. I. Brown, who spoke on standby or fixed charges in the energy rates. A form of rate in which the four months from November to February are considered off-peak and in which some modification of the demand charges is made was attacked on the ground that the utility could not ordinarily make use of the unused capacity in these months and therefore could not, in justice to itself, remit any part of the demand charges. The question as to whether such a rate is discrimination against other power consumers was also raised. A form of rate in which the summer demand is taken as twice the winter demand in order to compensate for the off-load period of the year was discussed by E. H. Kifer of San Antonio, Tex. This rate was said to have been very successful and to meet the common objection from the ice-plant owner to the payment of fixed charges during the winter months.

J. R. McCoy of Dallas, Tex., presented figures to show that the electric motor-driven plant for ice manufacture is most desirable because it requires the least amount of building space and the least amount of skilled labor and shows the least depreciation. With electrical energy at 1.5 cents, coal at $4.50 at the boiler room and fuel oil at 5 cents per gallon, the manufacturing costs of ice, including operating and fixed charges, were shown to be $2.17 per ton for an electric motor-driven plant, $2.34 with a uniflow steam-engine drive, $2.32 with a Diesel engine and $2.38 with a semi-Diesel engine. Although plant power costs in the electrically driven plant were shown to be 32 per cent of the cost, with fuel costs in the other plants at 11 to 14 per cent of the total, the lower investment, labor and maintenance costs give the electrically driven plant the advantage.

TECHNICAL SECTION

In the Technical Section meetings the treatment of boiler-feed water was advocated by C. B. Oliver of Dallas, Tex., who said that a test of boiler water daily, "flowing down" two to five times daily and regular feeding of chemicals in small quantities were the three requisites for successful operation of a small system. The material needed is a 50-gal. steel barrel, a supply of soda ash (58 per cent light), a water-testing outfit and the necessary connections to the feed-pump line. Before any treating is undertaken, Mr. Oliver said, an analysis of the water by a competent chemist is essential.

A maintenance schedule for Diesel engines was outlined by J. L. Schneitter of Dallas, Tex., who named inspections for each part of the engine, a maintenance calendar listing the time and frequency of inspections and a suitable report sheet as the essentials of such a schedule.

The combined registration of the Oklahoma Utilities Association and the Southwestern Geographic Division of the N. E. L. A. was more than 600, and the sessions were enthusiastic all the way through. Officers elected for the Southwestern Geographic Division are: President, J. W. Carpenter; vice-presidents, C. J. Griffith of Arkansas, W. E. Clements of Louisiana, J. L. Longino of Mississippi, J. F. Owens of Oklahoma and A. H. Warren of Texas. C. E. McBride of Dallas was re-elected treasurer.

St. Louis Has Well-Attended Electrical Exposition

The electrical exposition held in the Coliseum, St. Louis, March 12 to 17 inclusive, was a success both electrically and financially. More than thirty-five thousand persons attended during the week, notwithstanding some inclement weather. Several thousand articles portrayed development of electricity in industry, commerce, art and the home.

Special artistic effects made a striking setting for the exposition. A "sunburst" in various colors bore the sign "Electricity," which gradually changed to "Prosperity." Gauzy blue material veiled the ceiling and was made at intervals to appear like a starlit sky and at other times like daylight by a 100,000-cp. light source supplied by the General Electric Company and suspended in the center of the building. A chromatic fountain and an electric storm were among other illuminative features.

There were eighty-one exhibitors, including the Union Electric Light & Power Company, the Bell Telephone Company, the Westinghouse Electric & Manufacturing Company and the General Electric Company. C. E. Michel, sales manager of the Union Electric Light & Power Company, was president of the exposition company.

Division Meetings Planned for Contractor-Dealers

At an executive committee meeting of the Association of Electragists International held in New York City on March 14-15 a transcontinental trip was planned to be undertaken by James R. Strong and Laurence W. Davis, president and director of promotion and development respectively of that organization. The object of this trip, which will begin about the middle of June and end some time in August, is to hold divisional and other meetings of the membership. A plan is now being worked out whereby divisional meetings will become regular features in the future under the direction of and arranged by the association headquarters.

The tentative itinerary of the headquarters officials' coming trip includes Pittsfield, Mass., Chicago, Omaha, Denver, Salt Lake City, Los Angeles, San Francisco, Portland, Seattle; Vancouver, Calgary, Moose Jaw and Regina, Canada; Minneapolis and St. Paul.

States May Forbid Change of Existing Contract Rates

The Arkansas law prohibiting the Arkansas Railroad Commission from changing gas and other rates existing at the time authority to change rates was given to the commission is not discriminatory and comes within the power of the state, the United States Supreme Court has declared in effect, in reviewing an action brought by the Arkansas Natural Gas Company against the Railroad Commission.

The company sought an injunction

against orders for reduced rates to certain consumers which maintained in effect contracts with the Little Rock Gas & Fuel Company and the Consumers' Gas Company, the latter being a Hot Springs distributing company. The United States District Court granted the injunction in the first instance and denied it in the latter, the company appealing. The company sought a flat rate for city-gate delivery to the distributing companies, instead of the divisional rate which existed in the contracts, alleging that poor management made this divisional rate confiscatory.

Illinois Utility Men Hold Practical Meet

Educational Courses, Appliance Surveys, Prevention of Theft of Energy and the Merchandising of Appliances Are Leading Topics at Convention

PUBLIC utility educational courses at universities received emphatic indorsement from the third convention of the Illinois Utilities Association, held in Chicago on March 14 and 15. In addition to the speakers on this topic named in the preliminary report last week (page 647), Bert H. Peck of St. Louis and D. W. Snyder expressed their approval of the movement, which Dean Heilman of Northwestern University said would do much to provide utility organizations with a voice.

Edward Taylor, General Electric Company, Chicago, discussing the paper already noticed on "Remote-Controlled Substations," by H. E. Wulfing, Commonwealth Edison Company, before the Electric Section, held that a further use could be made of such a synchronized control for extending lines already in use. These substations have been so successful, he said, that inspections had been reduced from two a day to two a week.

How to handle customers caught stealing electricity was discussed at some length. In most such cases the meter is immediately removed to force the customer to come to the office and pay up before service is again given him. Mr. Williamson, Moline, Ill., stated that, upon this final settlement, his company installs a new type of inclosed service switch, conduit and meter flush to the wall which goes far to prevent tampering. He felt that legislation for prevention of energy theft could be well sponsored by the Illinois State Electric Association. Mr. Larkin, Public Service Company of Northern Illinois, said he found ten jumpers upon a single inspection trip in the South Chicago steel mill district.

A Story of Finance

The annual banquet was held Wednesday evening with Britton I. Budd as toastmaster. E. Hill Leith, Halsey, Stuart & Company, presented the financial story of public utilities. He figured the wealth of the entire United States back in 1858 to be equal to the present value of all public utilities—$16,000,000,000. With the country's total wealth today between $250,000,000,000 and $300,000,000,000, progress would depend upon the progress of the individual utilities. Mr. Leith enumerated five essential factors in financing utilities—cultivation of public appreciation of the needs of the industry, recognition of the fundamental principle that utilities must exist without competition, a vision of the next five years' developments, and a sense of the importance of common stock and of the growing necessity for non-par-value stock.

During the Thursday morning session E. W. Lloyd, Commonwealth Edison Company, spoke of the work of the Joint Committee for Business Development and urged the selection of local correspondents for the committees formed by the central stations and contractor-dealers in the various cities.

B. J. Mullaney, director Illinois Committee on Public Utility Information, told of the 108,000 column-inches of utility news that had been published by the newspapers during the past four years. Reviewing the work of the committee, Mr. Mullaney declared that during 1919 and 1920 many legislative bills were offered in the Illinois Legislature which were hostile to the utility industries, while in 1922 not a single such bill was presented.

Merchandising Appliances

The afternoon session was given over to merchandising problems. H. B. Gear, Commonwealth Edison Company, explained his paper surveying the electrical appliances used in Chicago. One peculiar item he found was that the number of washing machines in medium-sized houses averaged 46.2 per cent, while for apartments it was only 8.2 per cent. The flatiron was found to be the leader, while percolators were fewest in number.

The development of the "Mazda" lamp was described by F. T. Benson, General Electric Company, who demonstrated the new 30,000-watt incandescent lamp designed primarily for motion-picture work. He prophesied that the time would come when central stations would consider a change in their rates from an energy to a candlepower basis.

"Merchandising Domestic Appliances" was considered by R. S. Bell, United Appliance Company, Akron, who described the systems in use in northern Ohio. Weekly sales meetings lasting one hour are held in each district which are addressed by manufacturers' representatives and two or three salesmen. Regarding remuneration, Mr. Bell found it advisable to pay his district managers a salary plus a percentage of net profits, to pay his floor saleswomen a salary plus a small commission on all personal sales, and to pay the outside salesman a salary and commission, or a straight commission upon showing actual sales ability.

A. M. Floyd, Commonwealth Edison Company, spoke on electric cooking and cited a Chicago installation where a monthly saving of $65 was effected as compared with the old fuel-type range. Daniel Seymour, Edison Electric Appliance Company, said bakers save a half ounce of dough per loaf by electrical baking. In one case this raised production from 600 loaves to 695.

The officers for the ensuing year are: President, D. W. Snyder, Jr., Bloomington; vice-president, Bert H. Peck, St. Louis; secretary-treasurer, R. V. Prather, Springfield. The new members of the executive committee are R. S. Wallace, Peoria; H. O. Channon, Quincy; B. J. Denman, Davenport, and C. D. Ingersoll, Canton.

Indiana Companies Suffer from Heavy Storm

A heavy storm of wind and rain which swept over a large section of the Middle West last week, causing severe losses in Nebraska, Oklahoma and other states, made itself felt in Indiana, particularly in the southern part. Many industries in the northern half of Indianapolis were without light or power for twelve hours because of the destruction of poles and cables belonging to the Indianapolis Light & Heat Company. The Merchants' Heat & Light Company seemed to suffer less. The Indianapolis Street Railway and the interurban companies operating into Indianapolis were forced to suspend service for longer or shorter periods. The transmission wires of the Interstate Public Service Company between Shelbyville and Columbus were put out of commission and many poles went down. Electric light and street-car service in South Bend was crippled, and electric light service in Evansville was interrupted for some time. Traffic in Muncie was paralyzed by the breakdown of the Anderson power plant of the Union Traction Company.

Pittsburgh Utilities Corporation Is Formed

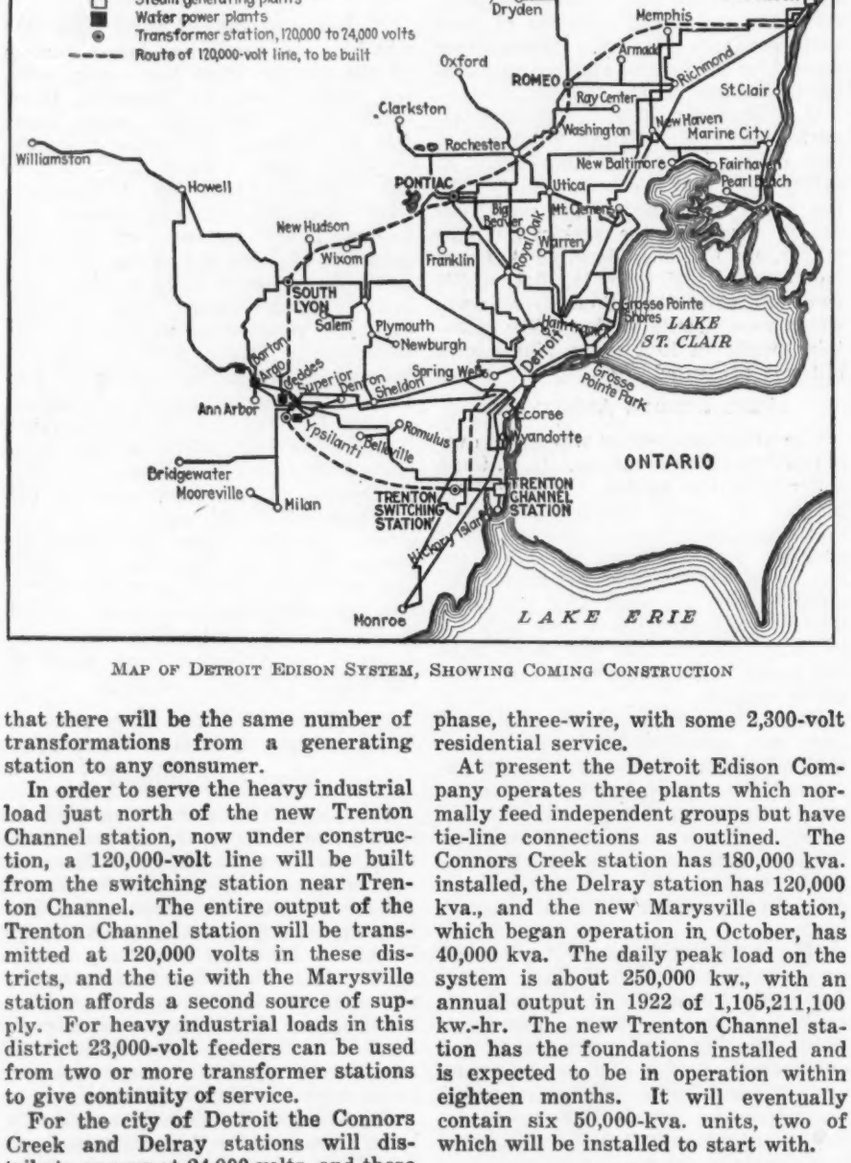
The detailed reorganization plan of the United Railways Investment Company, providing for the formation of a new corporation to be known as the Pittsburgh Utilities Corporation, has been announced by letters sent out by Mason B. Starring, president, to the stockholders. According to the plan the new corporation will take over from the company 480,000 shares of common capital stock of the Philadelphia Company, now pledged to secure an issue of bonds maturing May 1, 1926.

The object of the plan, the president's letter says, is to free the company from debt by retiring the existing bond issues and other funded indebtedness and by retiring both classes of dividend certificates, thereby removing restrictions against payment of cash dividends.

Detroit Goes to Pulverized Fuel

New Trenton Channel Station to Be Connected with Marysville by Semicircular 130-Mile, 120,000-Volt Transmission Line, Which Will Tie in with Other Lines

UTILIZING powdered fuel under the boilers of its new Trenton Channel station, the Detroit Edison Company purposes to meet the needs of its rapidly growing load by building a 130-mile, 120,000-volt double-circuit steel-tower line from that station through a half circle to its Marysville station. This high-tension line will be connected to the existing 24,000-volt, three-phase network at four transformer stations. Eventually 24,000-volt radial feeders will distribute the energy in the outlying territory from each of these transformer stations, so that there will be the same number of transformations from a generating station to any consumer.



MAP OF DETROIT EDISON SYSTEM, SHOWING COMING CONSTRUCTION

In order to serve the heavy industrial load just north of the new Trenton Channel station, now under construction, a 120,000-volt line will be built from the switching station near Trenton Channel. The entire output of the Trenton Channel station will be transmitted at 120,000 volts in these districts, and the tie with the Marysville station affords a second source of supply. For heavy industrial loads in this district 23,000-volt feeders can be used from two or more transformer stations to give continuity of service.

For the city of Detroit the Connors Creek and Delray stations will distribute energy at 24,000 volts, and these two stations are tied in with duplicate tie lines. The Marysville station will provide service for its local service and in addition will be tied to the high-tension system and the 24,000-volt network. At present there are two 48,000-volt lines from the city to Marysville, two others south to Monroe, one west to Ann Arbor and two northwest to Pontiac. Thus the systems now used are 24,000-volt underground cables of No. 2/0 size to substations in the city and 24,000-volt and 48,000-volt No. 0 overhead lines to outlying substations, and to these will be added the outer 120,000-volt high-tension line. All city distribution is underground at 24,000 volts to substations from which secondaries operate at 4,600 volts, three-phase, three-wire, with some 2,300-volt residential service.

At present the Detroit Edison Company operates three plants which normally feed independent groups but have tie-line connections as outlined. The Connors Creek station has 180,000 kva. installed, the Delray station has 120,000 kva., and the new Marysville station, which began operation in October, has 40,000 kva. The daily peak load on the system is about 250,000 kw., with an annual output in 1922 of 1,105,211,100 kw.-hr. The new Trenton Channel station has the foundations installed and is expected to be in operation within eighteen months. It will eventually contain six 50,000-kva. units, two of which will be installed to start with.

PULVERIZED FUEL ADOPTED

The new station will contain an initial installation of six type W Stirling boilers of about 2,900 hp. rating and will, as already mentioned, utilize pulverized fuel in the furnaces and main unit bleeding for the feed-water system. The changes in sizes of boilers and in practices in power production are well illustrated by the stations of the Detroit Edison Company. The Delray station contains nine 2,365-hp. boilers, two 1,300-hp. boilers and twenty-four 500-hp. boilers. The 500-hp. and two or three other boilers are equipped with economizers and the station uses open feed-water heaters and, for the most part, reciprocal steam-driven auxiliaries.

It is interesting to note, however, that when the older power house No. 1 turbine room at Delray was re-equipped in 1922 recourse was had to steam extraction from the main turbines for feed heating, with electrically driven auxiliaries. The arrangement is extremely simple since steam is bled from but one turbine stage and the proximity of the newer plant (power house No. 2) makes possible the omission of house turbines affording an independent supply of auxiliary power. The auxiliary system proposed for Trenton Channel, however, is the outgrowth of this earlier system, which has established its merit through these years of successful operation.

CONNORS CREEK PRACTICE

The Connors Creek station uses fourteen 2,365-hp. boilers with electrically driven auxiliaries and a vacuum system of feed-water heating in which the condensate from the main units is used as circulating water in the barometric condensers, which receive steam from the auxiliary turbo-generators. The evaporator system of make-up is also used.

In the Marysville station there are four 2,820-hp. boilers and all auxiliaries are electric with the exception of one reserve boiler-feed pump and a general service pump. The feed-heating system utilizes surface condensers with outside air coolers with evaporators for make-up water. The house turbines are bled for heating the building.

The Detroit Edison system is growing rapidly and serves a territory extending more than 100 miles north and south and more than 75 miles east and west. It has a system load factor of about 68 per cent and has taken a leading part in making new developments.

To Study New England Power

Charles T. Main of Boston, an industrial engineer, has accepted the chairmanship of the committee authorized by the executive committee of the Associated Industries of Massachusetts to make a survey of the power situation in New England. Associated with him will be Prof. Dugald C. Jackson, head of the department of electrical engineering, Massachusetts Institute of Technology; Henry I. Harriman, president of the New England Power Company, and George L. Finch, engineering superintendent of the Hood Rubber Company.

Brief News Notes

North Carolina State College Holds Meter School.—A school for electric metermen has just been held for the first time at the State College, Raleigh, N. C., under the auspices of the department of electrical engineering. The college made no charge for tuition, and in addition to the teaching staff of the department a number of the largest electric companies in the country agreed to furnish experts to assist with instruction and equipment.

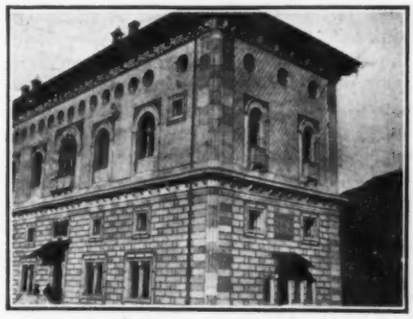
New Unit to Be Added at Roosevelt Dam.—An additional 7,500-kw. unit for further utilization of water at the Roosevelt Dam on Salt River, Ariz., will be installed by the Salt River Valley Water Users' Association. Nineteen control gates will be added in the spillways of the dam, and another dam and power house will be constructed further down the river to control the release of water for irrigation to permit of higher load factor on the present power plant at the dam. The Water Users' Association will issue $1,800,000 in 6 per cent bonds for financing the project. It is planned to have the new unit ready for operation within a year.

Interstate Public Service Company Grows.—A considerable increase in the business of the Interstate Public Service Company of Indianapolis in 1922 over the preceding year is shown in the president's annual report. A transmission line is being constructed between Cambridge City and Newcastle and plans have been made for important additions to the company's plants at Shelbyville and Jeffersonville. The report shows that the number of customers served by the company's utility plants was increased by 4,492 in the year. The connected lighting load was increased 11.8 per cent and the power load of Dec. 31 was 10.2 per cent greater than at the close of 1921. The total kilowatt-hours sold increased 25.2 per cent. Merchandise business shows a 50 per cent increase. The financial report showed gross earnings for the year of $4,276,665.78 and net earnings of $963,821.

Geological Survey Issues Power Map of Kentucky.—A map of Kentucky showing the locations of the power stations and transmission lines used in public service in that state and the names of the public utility companies has just been published by the United States Geological Survey. This map, which measures about 27 in. x 63 in. and is on a scale of about 8 miles to the inch, is the latest of the series of state power maps published by the Geological Survey. The others are of New York, Pennsylvania; Maine, New Hampshire and Vermont; Massachusetts, Rhode Island and Connecticut; Maryland, Delaware and the District of Columbia; New Jersey, Virginia, Indiana, and West Virginia. These maps may be purchased from the director of the United States Geological Survey for 50 cents each.

Research Graduate Assistantships.—The engineering experiment station of the University of Illinois again calls attention to the fact that, to assist in the conduct of engineering research and to extend and strengthen the field of its graduate work in engineering, the university maintains fourteen research graduate assistantships. Two other such assistantships have been established under the patronage of the Illinois Gas Association. These assistantships, for each of which there is an annual stipend of $600 and freedom from all fees except the matriculation and diploma fees, are open to graduates of approved American and foreign universities and technical schools who are prepared to undertake graduate study in engineering, physics or applied chemistry. This year the latest date for filing applications has been extended to April 1. Additional information may be obtained by addressing the director of the experiment station at Urbana.

How They Do It in Italy.—The accompanying picture is not of a millionaire's suburban villa, but merely the



"switch cabin" or substation of the Acciaierie Lombarde of Milan at Morbegno, Italy, near Como, the beautiful "home town" of Alessandro Volta. The company is installing a new high-tension line, and the building embodies its conception of what a substation should look like.

Some California Projects.—Applications for permits to appropriate water in California received by the State Department of Public Works during February included several relating to power projects. Of these the largest is that contemplated by W. H. Samson of Corning, who sought permission to use 1,250 sec.-ft. and 200,000 acre-feet of water from Clear Creek to be diverted into Shasta County. The application says that it is proposed to develop 128,000 hp. H. L. Shannon of San Francisco made application for a permit to appropriate 150 sec.-ft. of water from the Sacramento River, in Tehama County, with which to develop approximately 10,200 hp. A permit has been granted to P. B. Cross of San Francisco to appropriate water from Deer Creek, in Tehama County, for developing approximately 18,600 hp., and another has been issued to the Utica Mining Company of San Francisco for 6,144 acre-feet of water per year from Highland Creek, in Tuolumne and Calaveras Counties, to develop about 3,300 hp.

Associations and Societies

Northwest Electric Light & Power Association.—The annual convention of the Northwest Electric Light and Power Association, to be held in Seattle, has been set for June 27-30. N. W. Brockett is chairman of the program committee.

National Association of Manufacturers.—The twenty-eighth annual convention of the National Association of Manufacturers of the United States of America will be held at the Waldorf-Astoria, New York City, on May 14 to May 16.

Chamber of Commerce of the United States. — "Transportation in All Its Phases in the United States" and "Europe and Europe's Affairs" will be the two major topics considered at the eleventh annual meeting of the Chamber of Commerce of the United States in New York, May 7 to 10.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

Middle West Division, N. E. L. A.—St. Louis, April 11-12 H. M. Davis, Bankers' Life Bldg., Lincoln.

American Society of Mechanical Engineers—Pacific Coast meeting, Los Angeles, April 16-18; general convention, Montreal, May 28-31. C. W. Rice, 29 West 39th St., New York.

Tri-State Water and Light Association—Birmingham, April 17-20. W. F. Steiglitz, Columbia, S. C.

American Physical Society—Washington, April 21. D. C. Miller, Case School of Applied Science, Cleveland.

American Institute of Electrical Engineers—Spring convention, Pittsburgh, April 24-26; annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Sept. 25-28. F. L. Hutchinson, 33 West 39th St., New York.

American Welding Society — New York, April 25-28.

American Electrochemical Society — New York, May 3-5. Colin G. Fink, Columbia University, New York.

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Electrical Supply Jobbers' Association—Executive committee and general meeting, Hot Springs, Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

Missouri Association of Public Utilities—River boat from St. Louis to Peoria, May 24-26.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Electric Power Club — Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

North Central Division, N. E. L. A.—Minneapolis, June 13-15. H. E. Young, Minneapolis General Electric Company.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

Canadian Electrical Association — Montreal, June 20-23. Louis Kon, 65 McGill College Ave., Montreal.

American Society for Testing Materials—Atlantic City, June 25-29.

National Council Lighting Fixture Manufacturers—Hot Springs, Va., June 26-28.

Northwest Electric Light and Power Association—Seattle, June 27-30. G. E. Quinan, 204 Electric Bldg., Seattle.

Ohio Electric Light Association — Cedar Point, July 10-13.

Recent Court Decisions

Intercorporate Relations and Extension of Service.—Declaring that a public service corporation cannot minimize the duty it owes to the public by incorporating a portion of its distributing system, the New York Supreme Court held, in People ex rel. Woodhaven Gaslight Company vs. Nixon, that in considering the expense involved in an extension of gas service the New York Public Service Commission did right to consider the relation that existed between the company concerned and its parent company, which exercised absolute control over the defendant and three other distributing companies, and was not necessarily limited to a consideration of the expense with relation either to the capitalization or stated income of the relator. (196 N. Y. S. 623.)*

Power to Enjoin Illegal Operation.—The mere fact that a commission has no power to enforce its order cannot successfully be urged as a denial of the power to make the order when that power is expressly given it by statute, declared the Supreme Court of California in reviewing an order of the California Railroad Commission requiring the Motor Transit Company to cease alleged illegal operation. As a practical matter of procedure, the court said, such an order is proper. If the order so given by the commission is obeyed, then no further legal steps are necessary. It is only when such order is disregarded that it becomes necessary for the commission to institute an action in the courts to secure its enforcement. Until such order is given there is no basis upon which the commission can ask the aid of the courts. (209 Pac. 586.)

The Wisconsin Emergency-Rate Ruling.—The decision of the Supreme Court of Wisconsin overthrowing the uniform rates established by the Railroad Commission for cities included in the "loop" district of the Wisconsin-Minnesota Light & Power Company led, as already recorded in the news columns of the ELECTRICAL WORLD, to the adoption of emergency rates by that company until such time as the commission can determine proper charges on the unit plan now made obligatory. The commission refused to recognize these rates, wishing to revert temporarily to the rates previous to the abortive establishment of the "loop" plan, but the United States District Court granted to the company an injunction restraining the commission from interference with the emergency rates adopted by the company for Eau Claire, Chippewa Falls and Menomonie. In granting the injunction the court said: "If this proceeding were to fix definitely a fair and reasonable rate, we would doubtless say the burden is upon the utility. But such is not the purpose of the present suit. The utility is seeking to avoid the effect of a confiscatory rate. With the confiscatory character of the rate established, are we not required, as between the municipalities and the utility, temporarily to adjust the rates so as to avoid confiscation? . . . We are not at all sanguine that the good-faith efforts of the commission to carry out the rule announced by the Supreme Court will result in any easy and prompt disposition of the case. Whether its final determination be speedy or long delayed, whether it result in a substantial change in rate or not, the utility should, pending such hearing, be protected against an obviously confiscatory rate."

Protection of Crossing Wires. — In Farne vs. Pennsylvania Lighting Company damages were awarded for the death of a telephone lineman caused by the breaking of a wire with which he was working and its coming into contact with both an electric light wire and a trolley wire. The Supreme Court of Pennsylvania reversed the award, holding that it had not been established that the electric light wires were insufficiently insulated, as claimed by the plaintiff, and that there was evidence that the telephone wire became charged from contact with the trolley wire. The court also found that plaintiff's claim that it was customary for electric service companies to provide a "cradle" at points where telephone lines crossed above the transmission wires in order to prevent contact should a telephone wire sag or break was not sufficiently sustained, and said that the primary cause of the accident was the subjection of the old, worn-out telephone wire to a strain greater than it could withstand. (119 At. 537.)

Limited Power of Appellate Court Over Excessive Damages.—Sustaining the verdict for plaintiff found by the trial court in Smith vs. San Joaquin Light & Power Corporation, the California District Court of Appeal held that where a seven-year-old boy grasped a live wire hanging from an electric light pole to within a foot or two of the ground near the side of a public highway on which he was walking, the company was liable for injury, even though the accident arose in connection with rewiring being done by an independent contractor and though the wire was broken by the leaves of a large palm being blown against it. It was the defendant's duty to protect its wires from such danger. The court refused to reduce the damages awarded for the forced amputation of the child's arm below the elbow — $20,000 — declaring that it had power over excessive damages only where a point of law was involved or where the damages suggested at first blush prejudice, passion or corruption on the part of the jury. A rehearing of this case was subsequently denied by the Supreme Court of the state. (211 Pac. 843.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Approval of Contract Cannot Waive Provisions of Law.—In giving its approval to a contract for furnishing electrical energy entered into for three years between the Indiana Power Company and the city of Linton, the Indiana Public Service Commission took occasion to emphasize the mutual understanding of the commission, the city and the company that no contract or order could change the law applicable to public utility rates and service or waive the rights of the public.

Extensions Into New Territory.—In ordering the Springfield Gas & Electric Company to make an extension, under conditions, to serve an agricultural customer the Missouri Public Service Commission declared that an electric utility should not be required to add a new consumer to a line extended into new territory to serve other consumers who have contributed to the cost, have secured a right-of-way for their own personal service and have otherwise obligated themselves in connection with the extension, unless the additional applicant obligates himself to take service under the same conditions as the others.

Service in Adjacent Territory. — In adjudicating a complaint brought by the West Penn Power Company against the Vandergrift Electric Light & Power Company, the Pennsylvania Public Service Commission said that a public utility company incorporated for the purpose of supplying electricity to the public in a township and to "persons, partnerships, corporations and associations residing therein and adjacent thereto" cannot, under the adjacent-territory clause, extend its service beyond specifically designated territory into other adjoining municipal divisions in which another corporation is chartered to furnish a like service without a certificate of public convenience, even if "adjacent" persons is to be construed as meaning adjacent territory.

North Dakota Commission Changes Opinion. — Until quite recently the North Dakota Board of Railroad Commissioners had considered that historical costs have an almost controlling bearing upon a valuation, basing this opinion upon the requirement of the statutes that the value as determined by the commission "shall be such sum as represents as nearly as can be ascertained the money honestly and prudently invested in the property." Recently, in adjudicating a complaint brought against the Bismarck Water Supply Company, the commission announced that it had shifted its position, careful study of the authorities having convinced it that the words just quoted have a wider significance and a less restricted meaning than the actual number of dollars put into the property at its inception.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

G. N. Tidd Elected President American Gas & Electric

George N. Tidd, who has been associated with the American Gas & Electric Company for the last twelve years as vice-president and general manager in charge of operation, was elected president of the company at a meeting held March 14. Mr. Tidd is succeeding R. E. Breed, who was elected to the chairmanship of the board of directors. During the twelve years that Mr. Tidd served as vice-president and general manager the company attained a

G. N. TIDD

growth that ranks it with the foremost operating companies in the industry, and it was largely Mr. Tidd's foresight and courage that made possible the Windsor power plant of the Ohio Power Company, the first large power plant to be erected at the mouth of a coal mine. He has been a strong advocate of interconnections between large power systems, and under his management this policy has been pursued in Ohio. The latest example of his progressiveness is the 215,000-kw. plant of the Ohio Power Company on the Muskingum River below Zanesville which is now under construction.

S. Z. Mitchell was appointed chairman of the executive committee; Frank B. Ball, formerly secretary and treasurer, was elected vice-president and secretary, and F. W. Drager, formerly assistant treasurer, was elected treasurer.

Gilbert **Nerby** of North Menomonie has been appointed to succeed L. G. Webb, resigned, as district manager of the Menomonie office of the Wisconsin-Minnesota Light & Power Company. Mr. Nerby has been associated with the company for the last six years in the capacity of electrician. Mr. Webb, as was announced in the March 17 issue of the ELECTRICAL WORLD, tendered his resignation to enter into the real-estate business in Madison, Wis.

Herbert Baker Flowers has resigned as vice-president and general manager of the United Railways of Baltimore to become president of the New Orleans Public Service Corporation. Mr. Flowers became general manager of the United in 1919 and in 1920 was elected second vice-president of the company, continuing to discharge the functions of general manager.

Charles G. Du Bois, president of the Western Electric Company, accompanied by Vice-president H. F. Albright and Philip L. Thomson, advertising manager, sailed for Europe on the Aquitania on Tuesday, March 20. They plan to spend two months abroad, visiting the European factories and offices of the Western Electric Company.

J. Rowland Bibbins, formerly manager of the department of transportation, United States Chamber of Commerce, Washington, is now engaged in private consulting practice in transportation development, with offices in the same city. Previous to his association with the Chamber of Commerce Mr. Bibbins was supervising engineer with the Arnold Company of Chicago.

Harry A. Arthur, formerly of Stone & Webster, Inc., Boston, and the American International Corporation, New York, has been elected president of G. Amsinck & Company, Inc., of New York. Mr. Arthur was associated with Stone & Webster for more than ten years, spending much of that time in the field with electric light and power companies under Stone & Webster management. Ronald C. Shepard, formerly with the McGraw-Hill Publishing Company and prior to that with Stone & Webster, has been appointed vice-president and treasurer of the Amsinck company. During the world war Messrs. Arthur and Shepard were engaged in executive capacities with the American International Shipbuilding Corporation in the construction and operation of the Hog Island shipbuilding yards.

H. U. Wallace has been appointed assistant general manager of the Little Rock (Ark.) Railway & Electric Company. Mr. Wallace, who is well known in utility circles in the Middle West, has had an unusually active and interesting career. In 1894 he became identified with the Illinois Central Railroad and served as superintendent and chief engineer until 1905. Subsequently he followed private consulting engineering work and later became general manager of the Chicago, Lake Shore & South Bend Interurban. The year 1912 found Mr. Wallace at Boulder, Col., serving as vice-president and general manager of the Western Light & Power Company, where he remained until 1918, when he accepted an appointment as major in charge of engineering and construction, Quartermaster's Department, with headquarters at Washington, D. C. He left the army in the spring of 1919, and from that time until his recent appointment he was engaged in private practice.

C. W. Bradley Assistant to President Budd

Charles W. Bradley of Chicago, gas engineer of the Public Service Company of Northern Illinois in charge of all gas plants, has been appointed assistant to President B. I. Budd of that com-

C. W. BRADLEY

pany. Mr. Bradley was born in 1873 and was graduated from Cornell University in 1896 in engineering. The following year he went to Chicago and became superintendent of stations for the old Chicago Gas Light & Coke Company, afterward consolidated with the present People's Gas Light & Coke Company. Mr. Bradley remained there until 1905, when he became gas engineer for the Northwestern Gas Light & Coke Company. When the last-named company was absorbed into the Public Service Company of Northern Illinois, in 1913, Mr. Bradley came into the latter organization.

Prof. Lester P. Breckenridge, chairman of the department of mechanical engineering at Yale University, will retire from active teaching in June. Professor Breckenridge went to Yale from the University of Illinois fourteen years ago. He was graduated from the Sheffield Scientific School in 1881. Professor Breckenridge was at one time in charge of the boiler division, U. S. Geological Survey, fuel testing plant, St. Louis and he has written a number of bulletins on fuel conservation.

R. U. Muffley Washington Coast Utilities Manager

R. U. Muffley, formerly superintendent of light and power of the Bellingham division of the Puget Sound Power & Light Company, has been named manager of the Washington Coast Utilities properties recently acquired by the company first named. The properties of the Washington Coast Utilities, comprising seven electric, gas, water and telephone companies, will be operated as a separate unit for the present, under the direction of Mr. Muffley. His first work in the utility field was with the Fairmont Electric Light Company of Minnesota, back in 1899. In 1903 he went to the Pacific Coast and took a position with the Globe Electric Company, and in the following year he became affiliated with the organization of the Whatcom

R. U. MUFFLEY

County Railway & Light Company. This company absorbed the electric properties of the Bellingham Bay Improvement Company in 1906, and in 1908 Mr. Muffley was named superintendent of distribution. In 1911 he was promoted to the position of superintendent of light and power in charge of all light and power plants, street-railway lines and a gas plant owned by the company, which position he held until his recent transfer to the post of manager of the Washington Coast Utilities Properties. C. F. Terrell of the Seattle division has succeeded Mr. Muffley at Bellingham.

Chase Donaldson, formerly appraisal engineer with the American Gas & Electric Company, has resigned and is now an investigator for security issues with Hayden, Stone & Company, New York City.

J. T. Fulwiler, formerly connected with the Western Electric Company in Atlanta, Savannah and New Orleans, is now representing J. H. Parker & Son, Inc., Parkersburg, W. Va., throughout Arkansas, Oklahoma, Texas, New Mexico and Louisiana, with headquarters in Dallas, Tex.

C. E. Chapple is now chairman of the Fort William (Ont.) Light, Telephone & Street Railway System, replacing Charles Birkett.

Albert Uhl, formerly connected with the Henry Newgard Company as sales engineer, has joined the Nordlie Electric Company, Chicago.

Harvey Clark Pond, general sales manager of the Arrow Electric Company, Hartford, Conn., has been elected a member of the board of directors.

E. A. Graham, formerly connected with the Electric Bond & Share Company, New York City, has gone to Cienfuegos, Cuba, where he will be with the Compañia Electrica de Cienfuegos.

A. H. Favreau has replaced George W. Cook as superintendent of the Southern Illinois Railway & Power Company, Harrisburg, Ill. Fred L. Shimer has been made general superintendent and M. H. Wetlaw has been appointed as general agent.

Paul P. Ashworth, distribution engineer of the Utah Power & Light Company, has been unanimously re-elected to represent the Utah Section of the American Institute of Electrical Engineers on the governing board of the Engineering Council of Utah. His term of office will expire Jan. 1, 1925.

R. J. S. Pigott, formerly connected with the Crosby Steam Gage & Valve Company of Boston, as works manager, has recently become associated with Stevens & Wood, Inc., as mechanical engineer in charge of all the power and industrial work of the company. Mr. Pigott has been retained by the Boston company in a consulting capacity.

C. V. Woodward has been appointed manager of the Baltimore office of the Westinghouse Electric & Manufacturing Company, and F. C. Reed has been made manager of the Huntington (W. Va.) office. Other changes in the branch offices include the appointment of R. J. Ross as assistant manager of the transportation division of the Philadelphia office and of W. F. James to the managership of the industrial division, succeeding R. F. Moon, who has resigned to accept the vice-presidency of the Atlantic Elevator Company of New York.

Kenneth V. Laird has been placed in charge of a new department recently organized by the Capital Electric Company of Salt Lake City, Utah, which covers Utah, southern Idaho and parts of Nevada and Wyoming as an electrical jobber. This department is to be known as the transmission and street lighting department and has been organized for the purpose of affording technical service to customers in the working out of their problems. Mr. Laird is a graduate in electrical engineering of the University of California with the class of 1914. Prior to the war he was a member of the staff of the Anaconda Copper Mining Company in connection with the Cottrell process. More lately he was electrical engineer for the Gillert Engineering Company of Philadelphia.

Dr. Merrill Heads Engineering Council of Utah

Dr. Joseph Merrill, dean of the Engineering College of the University of Utah, has been elected president of the Engineering Council of Utah. He has been active in the organization of the Engineering Council, which is an affiliation of all of the engineering societies of Utah, representing about fifteen hundred men of the engineering profession. Dr. Merrill received his bachelor of science degree from the University of Michigan in 1893 and continued his studies at the Johns Hopkins University, receiving his Ph.D. from that institution in 1899. He was assistant professor of chemistry at the University of Utah in 1897, director of the Utah State School of Mines at the University of Utah in 1898, and since 1899 has been professor of physics and

JOSEPH MERRILL

electrical engineering of that institution.

Dr. Merrill has done extensive research work in electrical engineering. He has been very active in the Utah Section of the American Institute of Electrical Engineers and served as chairman of that section during the association year 1920-1921.

Obituary

Henry H. Ashley, president of the Hazard Manufacturing Company, manufacturing cable at Wilkes-Barre, Pa., died recently.

Alexander Lodyguine, inventor of many electrical and chemical processes, died on March 16 at the Brooklyn Hospital after a long illness. Mr. Lodyguine, who was seventy-five years old, was a member of the American Institute of Electrical Engineers and of the American Electrochemical Society. Among his inventions were a carbon incandescent lamp, a flying torpedo, electrical heating and hardening furnaces, a storage battery and chemical apparatus.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Stabilizing the Sale of Commodities*

Reasons for Favorable Merchandising Outlook—Quality Versus Price as a Trade Factor—Incentives to Sales Effort

By A. G. Kimball
President Landers, Frary & Clark, New Britain, Conn.

OUT of the war and the subsequent short period of depression has come a new prosperity which presents a great opportunity for every one in the merchandising field and especially to those engaged in marketing household conveniences. Prohibition, the servant problem and the modern woman are primary factors in the development of electrical merchandise sales.

A great deal of the money formerly spent for the "fifty-seven varieties of liquid joy" is now available for home conveniences. A greater percentage of the family income than formerly is now expended by women in the homes of the country, and even among conservative people much more entertaining is done than in years past. There is increased interest in the appointments, conveniences and luxuries of home life, with a tendency toward the purchase of more refinements of living, which all together make a considerable market for electrical products that previously did not exist.

From all indications the scarcity of servants will continue many years. The desire for individual freedom, unwillingness to perform "menial" service, the demand for stated hours of work, and shorter hours at that, combined with unwillingness to tie one's self down, contribute to the shortage of domestic help. Competent servants are hard to obtain and insist on modern conveniences as a condition for remaining.

Women are now performing household tasks who would not have thought of this work ten years ago. The demand for household conveniences grows apace. *Electrical Merchandising's* forecast of household sales prospects in electrical appliances has exceeded the estimates of manufacturers and yet has been found accurate in the light of past experience. This journal estimates that in 1923 $160,000,000 will be expended in this country for electrical household devices and conveniences. A building boom is in progress throughout the country. Manufacturers of builders' hardware cannot keep up with orders. All new homes are potential customers of the electrical industry. It is estimated that the number of wired homes in the United States will increase from six and one-half million in 1921 to eleven million by 1924—virtually doubling the number having electric service.

Let the Central Station Back "Quality" Products

Each newly wired home means a new customer for the central station. The central station has in its tie-in with its customers an advantage comparable to that of the department store with its "charge accounts." Twenty million establishments in this country are engaged in the housekeeping business. In reaching out into this potential market for the sale of electrical devices the central-station company has the best opportunity possessed by any branch of the industry.

It is generally true that where a central station is actively merchandising in a community it creates more business than formerly existed there in the appliance field for every one engaged in the local supply of electrical commodities, provided that the central station maintains a proper policy. It is to the interest of the entire industry that list prices be maintained, although sales stimulation of one kind or another is favored on occasion. Special sales are desirable once in a while—every woman loves a bargain—as in department store merchandising, but these special sales should prevail for a limited period only, with reductions on the cheaper brands of goods and the maintenance of profits on regular lines.

The department store has studied every phase of the merchandising problem and worked out its plans, analyzing the details of buying, selling and service. The electrical industry needs to do the same thing. The question of turnover, for example, needs more thorough consideration.

As electrical manufacturers, we believe it is a mistake for merchandisers to buy of all producers of electrical commodities. It is better to feature one or two brands, to be headquarters in a community for particular products. More business is done than in cases where the retailer handles a big variety of goods. Fewer "frozen" stocks or sacrifice sales develop under a policy of concentration, which means more incentive for the manufacturer and jobber to co-operate with the dealer who does not attempt to cover too great a variety of lines.

It is a temptation for the buyer to "fall for" some of the bargains offered by relatively unknown producers, and so a policy of concentration leads to the creation of fewer choked-up stocks.

Cheaper Merchandise Threatens Market

As a result of the expiration of the Marsh patent a decided tendency toward the production of lower-grade merchandise can be seen and central stations and other retailers will make a mistake if they buy from cheaper producers who sacrifice quality to price. Business cannot be built up on price, and there is going to be a real battle between price and quality in electrical merchandising. The manufacturer's reputation is the best guarantee of the appliance.

What should the central station do to go after this business in an aggressive manner? Some one with real merchandising ability and instincts should be put in charge of this end of the business. Too often in the past a purely technical man has been in charge of sales activities.

*From an address before the Merchandising Bureau, New England Division, N. E. L. A., at Hartford, Conn., March 14, 1923.

A vital question is how to keep such employees. Some plan should be worked out so that the merchandising man may in some way be made a partner in this business, as on a salary and bonus basis. In the past too much emphasis has been placed on the lighting load as a revenue producer. There is a far greater opportunity in appliances. If all central stations could be given the name "The Blank Electric Company," it would facilitate the sales activities of the industry. Try to serve the public when people enter the utility office. Don't permit any employee to "bark" at the public. Things jar in a public utility that would never be given a second thought in private industry.

A courteous and intelligent person at or near the door is essential. In general, manufacturers stand ready to co-operate to the utmost in developing the merchandising field in the electrical industry, which offers tremendous opportunities for progressive organizations.

Police Power Needed in Maintaining Quality

Devices Sold for Use in the Home Should Be Protected by an Approval from the Central-Station Industry that Each Utility Could Enforce

BY S. D. LEVINGS
Treasurer Betts Electric & Manufacturing Corporation, New York

SOMETHING definite and positive should be done to protect the purchasing public against electrical devices of inferior quality. The Underwriters' Laboratories are not vested with the police power that would enable them to eradicate from the market cheap and hazardous devices. They afford purely a moral protection for the insurance company and the insured, and it is a well-known fact that very few fires occur in homes employing non-approved apparatus, where the insurance companies refuse for that reason to pay the loss covered by the policy. The question therefore is: Could an organization established by the central-station companies themselves exert the power the underwriters do not possess by disseminating information on approved apparatus through the central stations direct to the consumer?

EFFECT ON THE TRADE

It may be said that this is not the function of a public utility. But surely it would protect the public and improve the service and so would be in the public interest. I believe that it would be effective because a strong influence would be exerted if the consumer were to receive regularly with his bill a list of apparatus that was approved with a statement that the central station could not be held responsible for trouble or improper functioning of the service if devices other than those approved should be used.

Such an approval should not tend to uphold the big manufacturer in opposition to the smaller manufacturer, for there are many smaller concerns that manufacture electrical apparatus superior in quality, workmanship and functioning to that made by some of the larger manufacturers; but it should influence the jobber and the dealer in their purchasing.

The dealer buys generally on one or two bases—that of his own judgment, based on first-hand information, or that of judgment based upon sales effort directed to him on the part of the manufacturer. With two articles side by side of known quality, he will buy the low-priced, which generally is of inferior quality, unless the higher-priced article has been so extensively advertised by the manufacturer as to create a demand from which the dealer can automatically benefit. The jobber buys an article for which there is a demand, and the manufacturer who cheapens his product to spend the savings in advertising can certainly make headway against a manufacturer of a high-grade article who does not possess a large enough advertising appropriation to compete with him.

But in approving a device all such aspects should be eliminated from consideration. The only question to be determined would be the suitability of a device for use by the novice, and I would further eliminate any apparatus not sold at retail to the householder. Thus, I do not believe it would be necessary to pass upon fixtures, conduit, conduit fittings, wire, switches and similar things, as the standards on this class of goods are pretty well recognized and a manufacturer who cannot live up to the building code requirements, the various underwriters' rules and local ordinances has little chance of doing much damage.

I have in mind a specific accessory device, a double socket. The body of the plug is made of bakelite, the best insulation obtainable. There is no porcelain in any part of its construction to cause trouble through breakage. There are no internal connections of any kind. Brass shells are eliminated. There is a spring contact at every point. Purely on the technical merits, it is clear that the absence of fragile porcelain parts is a distinct advantage to the consumer. The elimination of soldered connections, which are only as good as the workman who makes them and which are liable to open on overloads and to cause high-resistance joints, is a decided advantage. Trouble due to arcing contacts in sockets with solid connections are avoided because there is not a solid contact in this plug.

Now, it would seem that every electrical man of experience would wish to adopt this device. The manufacturer has been told on all sides that he has a wonderful article but that, inasmuch as he has not created a demand, purchasers of two-way sockets will not become interested. I know of no more striking illustration of the lack of appreciation on the part of the trade of quality for the sake of quality.

WHERE THE PEOPLE LOOK

The indorsement of such institutions and periodicals as the Tribune Institute, *Good Housekeeping* and the *Modern Priscilla* is of value and interest, but the public certainly does not look to such organizations for technical electrical advice. It naturally looks to the central stations for such information.

I do not believe that it would be a difficult matter to test or to arrive at a method of analyzing the quality of the various devices used in the home. As a matter of fact, I believe that a specification for general points of construction and performance should be written for each type of such devices and that their testing should be made in strict accordance with such specifications.

I feel that the time is coming when the central-station companies will have to take a firm stand in the matter of the quality of apparatus

that is to be attached to their lines; and as no one station could stand the burden of the work involved, it appears as though a concerted effort would be necessary, with a common fund to carry on the work in a scientific and proper manner. I agree that it would be folly to put this work in the hands of any but the central stations. Certainly they cannot be accused of bias.

The whole object of the idea would be to protect the patrons of the utilities, who expect and are entitled not only to electric service but to service in a broader sense in all that pertains to their use of energy.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

January Electrical Exports Show Gain

Total exports of electrical machinery, apparatus and appurtenances for the month of January were $6,400,943, a gain of $1,587,199 over January, 1922, when the total amounted to $4,813,744. The following figures are supplied by the Bureau of Foreign and Domestic Commerce:

ELECTRICAL EXPORTS FOR JANUARY, 1923, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

Articles	Value January 1922	Value January 1923
Turbines	$202,304	$175,111
Generators:		
Direct-current—		
Under 500 kw	42,505	60,374
500 kw. and over	169,675	130,406
Alternating-current—		
Under 2,000 kva	4,952	19,819
2,000 kva. and over	79,876	99,890
Accessories and parts for generators	250,605	90,108
Self-contained lighting outfits	39,776	66,246
Batteries:		
Primary	74,126	97,324
Storage	51,701	221,721
Transforming and converting apparatus:		
Transformers—		
Power	83,953	192,153
Other	106,633	35,471
Rectifiers, condensers, double-current and motor generators, dynamotors, synchronous and other converters	67,872	53,701
Transmission and distribution apparatus:		
Switchboard panels, except telephones	44,766	132,168
Switches and circuit breakers above 10 amp	175,382	220,987
Fuses and fuse blocks	13,259	17,898
Meters and measuring instruments:		
Watt-hour and other measuring instruments	66,116	19,184
Volt, watt and ampere meters and other recording indicating and testing apparatus	68,006	64,859
Lightning arresters, choke coils, reactors, and other protective devices	14,230	48,149
Motors, starters and controllers:		
Motors under 1 hp	36,146	73,112
Stationary motors, 1 to 200 hp	146,523	193,386
Stationary motors over 200 hp	3,681	45,087
Railway motors	390	21,995
Electric locomotives—		
Railway	17,505	874,739
Mining and industrial	8,926	6,170
Other motors	65,563	7,023
Rheostats, controllers and other starting and controlling equipment	73,501	116,270
Accessories and parts for motors	146,521	100,696
Electrical appliances, etc:		
Electric fans	46,395	48,972
Electric lamps:		
Incandescent—		
Carbon-filament	3,050	3,357
Metal-filament	95,057	82,541
Other electric lamps	17,350	18,142
Flashlights	14,855	27,450
Searchlights and projectors	140,040	38,557
Motor-driven household devices	22,704	46,970
Domestic heating and cooking devices	38,540	55,989
Industrial electric furnaces and ovens	22,951	8,960
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc	41,703	34,229
Signal and communication devices:		
Radio and wireless apparatus	9,274	141,577
Telegraph apparatus	25,380	392,992
Magneto telephones	*	490
Other telephones	370,055	28,467
Magneto switchboards	*	20,242
Other telephone switchboards	*	18,125
Railway signals, switches and attachments	45,901	32,616
Bells, buzzers, annunciators and alarms	4,043	6,032
Other electrical apparatus and appurtenances:		
Spark plugs, magnetos, and other ignition apparatus	104,311	68,055
Insulating material	56,498	66,828
Metal conduit, outlet and switch boxes	53,655	16,089
Sockets, receptacles and lighting switches	10,738	68,589
Other wiring supplies and fixtures	79,375	153,108
Other electrical apparatus not elsewhere specified	838,313	804,528
Globes and shades for lighting fixtures	35,272	27,235
Electrical glassware, except for lighting	12,082	15,332
Electrical porcelain	103,923	138,134
Electrical carbons, carbon brushes and electrodes	19,543	146,938
Insulated wire and cable (iron and steel)	80,618	68,237
Other manufactures of aluminum	40,602	53,395
Copper:		
Bare wire	64,486	212,282
Insulated wire and cable	234,537	209,508
Total electrical exports	$4,813,744	$.400,943

* Not separately stated prior to Jan. 1, 1923.

Aluminum Output Gained 25 per Cent in 1922

The value of new aluminum produced in the United States during the year 1922, according to the United States Geological Survey, was $13,622,000, an increase of about 25 per cent over 1921. During the first half of the year the price was 20 cents a pound. In September, when the tariff went into effect, the price advanced to 23 cents, where it remained until the end of the year. The price is now 26 cents.

Imports for the first nine months of the year amounted to 31,482,893 lb., compared with 26,177,852 lb. for the corresponding period in 1921. Value of manufactured articles of aluminum during the same period was $1,486,177, compared with $1,635,106 imported during the first nine months of 1921. Figures for the last three months of 1922 are not yet available.

Atlanta Collections Improving

Collections in the Atlanta district showed little change during last month, and jobbers reported their collections quite satisfactory. There is still some tendency toward slowness by the small contractors, but even this element is showing signs of increasing promptness. Industrial companies and public utilities are liquidating their accounts more promptly, and jobbers report that credit is easier and more liberal than has been the case for some time past as they anticipate excellent conditions later in the spring. Money continues easy, as is evidenced by the heavy building activities throughout the territory.

The Metal Market

No Sign of Weakening Price—Export Market Quiet—February Shipments 180,000,000 Lb.

Practically all producers continue to hold their copper at 17 cents delivered. There is no sign among most producers of weakening on this quotation, and, being well sold up, they seem willing to wait two or three weeks if necessary for the demand to reassert itself. The export market has been more quiet than usual, at prices that have netted producers approximately the same as domestic business.

Foreign and domestic shipments of copper during February totaled 180,000,000 lb. With allowance for the shorter month and holidays in February, this figure maintained the same high rate as in January, when the largest shipments in the peace-time history of the industry were made, totaling 210,000,000 lb. Refining output during February amounted to about 160,000,000 lb., resulting in reduction of refined stocks by 20,000,000 lb. On March 1 these stocks totaled 255,000,000 lb., compared with 275,000,000 lb. on Feb. 1. Indications point to the shipment of a total of 225,000,000 lb. in March.

NEW YORK METAL MARKET PRICES

Copper	Mar. 14, 1923 Cents per Pound	Mar. 21, 1923 Cents per Pound
Electrolytic	16.75	17.00
Lead, Am. S. & R. price	8.15	8.25
Antimony	8.75	8.75
Nickel, ingot	30.00	30.00
Zinc, spot	7.50	7.50
Tin, Straits	46.00	47.25
Aluminum, 98 to 99 per cent	25.50	26.00

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

SLIGHT improvement in orders throughout the United States is noticeable following buying on the rising market for porcelain, copper and brass products after decided rises in raw materials during the greater part of the last four weeks. Along the Pacific Coast the demand for rubber-covered wire, which was marked up 2 per cent last week, has slowed up owing to the heavy stocks now in the hands of the contractor-dealers, who bought far in advance in anticipation of higher prices. In that territory the conduit situation is unimproved, deliveries are slow, and factories will accept orders subject to price on date of shipment. In the South electrical business is experiencing a wholesome demand as excellent weather conditions have permitted building activities to go ahead rapidly. In the Middle West industrial-equipment sales of commodities to the utilities are growing with stiffening prices. Other business incident to newly constructed buildings is, however, delayed to some extent by labor difficulties. In the East business continues very active, with some improvement in the delivery situation, although railroad embargoes are still bothering shipments of raw materials. In New England there is talk of strikes in the textile industry. Radio sales are well maintained and appliances are receiving unusual attention for this time of the year. Collections generally are much improved.

Boston Business continues very active, and there is moderate improvement in the delivery situation, although railroad embargoes are widespread. Building contracts awarded in New England for the week ended March 13 totaled $4,654,200, against $3,974,100 for the same week last year. A deadlock in the building industry at Boston regarding wage increases has caused cancellations of contracts exceeding $2,000,000, and it is not unlikely that a struggle to establish the open shop may occur this spring. Strikes threaten the textile industry at Fall River and New Bedford, Mass. Important new central-station construction is contemplated at Worcester, Mass., and Providence, R. I. Spring demand is opening in line material and appliance sales are showing up well. New England electrical factories are extremely busy.

New York Prices all through the copper and brass lines continue strong, following rises in the raw-material market. Insulators, poles and meters are moving in greater volume to the utilities, and wiring devices, fixtures and appliances are receiving more interest than one month ago. Electrical manufacturers throughout this territory are very busy filling spring and summer orders and are having less difficulty in obtaining raw materials from the inland. Heater sales during the last three months have been far in excess of any like period of three years back as a result of intensive sales efforts in the form of newspaper advertising, more attractive displays and the coal shortage. Business in second-hand motors is said to be more brisk than two weeks ago.

Baltimore General market conditions are holding their own, with very good prospects for the late spring and summer seasons. There is but small demand for flatirons and a good many of the jobbers are understocked. Motors and transformers are keeping steady and wire has had an active week.

Atlanta Business in electrical lines is increasing steadily. Excellent weather conditions have permitted building activities to go ahead rapidly and a healthy demand is to be noted in all electrical building materials. Irons are selling briskly. One jobber is in the midst of a statewide campaign and reports excellent results with ample stocks to meet the demand. Another jobber anticipates sales campaigns beginning April 1. Demand for batteries of all types continues active and sales are considerably in excess of the same time last year. The outlook in this line is bright, and satisfactory stocks and firm prices are the rule.

Pittsburgh Jobbers report fair business from utilities and industrials. The price trend in practically all commodities in this territory is upward, and yet business seems to be getting stronger as each week goes by. Radio shows a marked improvement, and, as previously reported, people demand a better class of equipment than ever before. Business among the building trades continues to improve.

Cleveland General business conditions are much improved. Construction is delayed somewhat by labor difficulties, although builders' plans included an extensive program for spring. Conduit stocks are low and also tend to hamper building operations to some degree. Industrial equipment sales are good, and prices of pole-line hardware, wiring devices, armored cable and high-tension equipment are stiffening. Deliveries are lengthening again, although railroads report their rolling stock to be greater. Appliances are in very good demand, particular strength in cleaners being noticed. Central stations report power sales increasing and meters are in good demand. Radio prices are declining, although sales are active. Collections are reported as improved.

Chicago Demand for staples, including wire, switches and wiring devices, is continuing firmly. Stocks are normal with the exception of conduit and porcelain. The call for motors is growing and more apprehension is given to the scheduling of shipments than to the cost of motors, which has remained firm. Demand for poles remains active and stocks are fairly normal with firm prices. Call for radio is steady and stocks are normal with the exception of a few commodities, including the 1.5-volt vacuum tube. The tape market has noticed no fluctuations, since both the rubber and the cotton grade have a steady call.

St. Paul-Minneapolis The extreme cold weather during the last few days has stopped construction and all outside work has slowed up considerably. Dealers are ordering from hand to mouth. Wire is still going up. The conduit situation is very serious, with acute shortages in small sizes. Radio has slowed up.

Denver Increased prices of electrical materials dependent on copper and steel are not uniform, and, because of the uncertain market, no heavy buying for stock is being done. Central-station buying is consistent and indicative of considerable activity later. Jobbers report improvement in stocks, but in several lines, owing to the large demand, manufacturers are making short shipments. Wire stocks, however, are ample, while larger sizes of conduit are short. Recent blizzards have impaired all transmission lines, but no serious damage has been reported. Range makers are surveying territory closely for development of electric cookery campaigns. Appliance sales are picking up.

St. Louis Production and distribution of merchandise in this district for the past month have been relatively larger in volume than is usual at this season of the year and have shown large gains over the corresponding period of the two preceding years. Practically all building materials have increased in price. Wholesalers report that their customers are taking advantage of prompt payment discounts to a greater extent than they have done for more than two years. Dealers in electrical appliances report large sales, all lines showing an increase over last year.

Portland-Seattle Lumber production reached a new high post-war peak last week. Increased lumber prices are reflected in higher prices for poles and cross-arms. Deliveries on cross-arms are very slow owing to the greatly increased demand. A 2 per cent increase in rubber cov-

Demand, Supply and Price Trend of Nineteen Commodities as Sold in Sixteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week
Reports will include
Conduit Boxes, Rectifiers
and Instruments

	Wire	Armored Cable	Conduit	Transformers	Poles	Pole Line Hardware	Porcelain	High Tension Equipment	Fuses	Meters	Switches	Wiring Devices	Lamps	Commercial Fixtures	Motors	Radio	Tape	Batteries	Irons
Boston																			
Demand	Act.	Act.	Act.	Act.	Act.	Act.	Act	Act.	Sdy.	Act.	Act.	Act.	Act.	Act.	Act.	Act.	Sdy.	Act.	Act.
Supply	Nml.	Nml.	Low	Nml.	Low	Nml.	Low	Low	High	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Dec.	Firm	Firm	Firm
New York																			
Demand	Act.	Act.	Sdy.	Act.	Act.	Act.	Sdy.	Act.	Act.	Act.	Act.	Act.	Act	Sdy.	Act.	Act.	Sdy.	Act.	Act.
Supply	Nml.	Nml.	Low	Nml.	Low	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Low	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Inc.	Firm	Firm	Inc.	Firm	Inc.	Firm	Firm	Firm	Firm	Dec.	Firm	Firm	Firm
Baltimore																			
Demand	Act.	Slow	Act.	Sdy.	Slow	Slow	Sdy.	Slow	Act.	Slow	Act.	Act.	Act.	Slow	Sdy.	Sdy.	Sdy.	Sdy.	Slow
Supply	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Low	Nml.	Nml.	Nml.	Nml.	Low
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Atlanta																			
Demand	Act.	Act.	Act.	Sdy.	Act.	Act.	Act.	Slow	Act.	Act.	Act.	Act.	Act.	Act.	Sdy.	Sdy.	Act	Act.	Act.
Supply	Low	Nml.	Low	Nml.	Low	Nml.	Nml.	Low	Nml.	Nml.	Low	Nml.	Nml.	Low	Nml.	Nml.	Nml.	High	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Pittsburgh																			
Demand	Act.	Sdy.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Sdy.
Supply	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Firm	Firm	Firm	Inc.	Firm	Firm	Inc.	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Cleveland																			
Demand	Act.	Act.	Act.	Act.	Sdy.	Act.	Sdy.	Act.	Sdy.	Act.	Act.	Act.	Sdy.	Act.	Act.	Act.	Act.	Act.	Sdy.
Supply	Nml.	Low	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Chicago																			
Demand	Act.	Sdy.	Act.	Act.	Act.	Sdy.	Slow	Act.	Sdy.	Act.	Sdy.	Act.	Act.	Act.	Act.	Act.	Sdy.	Act.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Dec.	Firm	Firm	Firm
St. Paul-Minneap.																			
Demand	Act.	Slow	Sdy.	Sdy.	Act.	Act.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Slow	Sdy.	Sdy.	Sdy.	Slow
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Firm	Inc.	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm
St. Louis																			
Demand	Act.	Sdy.	Act.	Sdy.	Slow	Sdy.	Sdy.	Act.	Sdy.	Slow	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Act.	Sdy.	Sdy
Supply	Low	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Inc.	Firm
New Orleans																			
Demand	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Slow	Slow	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Sdy.	Act.	Sdy.	Sdy.	Sdy.
Supply	Low	Nml.	Low	Nml.	Low	Low	Nml.	Low	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Low	Nml.	Slow	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Firm
Denver																			
Demand	Act.	Act.	Act.	Slow	Sdy.	Sdy.	Sdy.	Slow	Act.	Slow	Sdy.	Act.	Act.	Act.	Slow	Act.	Sdy.	Act.	Sdy.
Supply	Nml.	Nml.	Low	Low	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Firm
Salt Lake City																			
Demand	Act.	Sdy.	Act.	Sdy.	Sdy.	Slow	Act.	Sdy.	Slow	Sdy.	Sdy.	Sdy.	Act.	Act.	Slow	Sdy.	Act.	Sdy.	Sdy.
Supply	Low	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Hi.	Nml.	Nml.	Nml.	High	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Firm	Inc.	Firm	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Inc.	Firm	Firm	Firm	Firm	Firm
Portland-Seattle																			
Demand	Act.	Act.	Act.	Act.	Act.	Act.	Slow	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Firm	Inc.	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Inc	Firm	Firm	Firm	Firm	Firm	Firm	Firm
San Francisco																			
Demand	Act.	Act.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Sdy.	Act.	Act.	Act.	Act.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Low
Price trend	Inc.	Inc.	Firm	Firm	Firm	Dec.	Dec.	Firm	Inc.	Firm	Inc.	Inc.	Firm	Dec.	Firm	Firm	Firm	Firm	Firm

ered wire is reported. Demand for this wire has slackened somewhat owing to heavy stocks recently purchased by contractor-dealers in anticipation of a rising market. The conduit situation is unimproved. Deliveries are slow and factories will accept orders only subject to price on date of shipment. Since the expiration of the patent rights on resistor wires, inferior irons have appeared on the market. Jobbers are preparing for this competitive situation by handling a second-grade iron, which is good but not so expensive as the standard lines. Sockets and snap switches have advanced about 7 per cent. Credits are freer except in the contractor-dealer class. Collections have slowed up materially, the average length of time for outstanding accounts in the Northwest for February being fifty-seven days.

Salt Lake City The mining industry has recovered something of its old-time prosperity, five silver-lead mines alone depositing $600,000 each month in Salt Lake City banks from net earnings. The wool industry is also well stabilized, prices being at a high level. Sugar-beet growers continue to get bonus money on their 1922 crop as sugar prices tend upward. It is predicted that a building boom, unprecedented in Utah's history, will be launched this spring. Merchandise generally is moving better. Collections are much improved.

San Francisco California jobbers have cautioned their salesmen to watch all quotations and delivery promises because of changing markets, shortages of labor and raw materials in the East. Many large orders have been reported, this being a season of annual requirement purchases, such as eleven cars of fiber conduit, about $100,000 worth of paper cable for underground work in San Francisco and nearly 500,000 ft. of rubber-covered wire for overseas shipment. It is reported that electrical work in the new government tubercular and service sanitarium will amount to approximately $150,000. Radio business is improving steadily. Better broadcasting service is largely responsible for this.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

G. E. Erie Works to Make Same Type Transformers as Built at Pittsfield

To care for the increased transformer business of the General Electric Company, it is announced that arrangements have been made for the Erie works of the company to manufacture transformers of the same type as those built at the Pittsfield works. It is expected that production will be started some time next month.

Erie-built transformers will be manufactured along the engineering lines directed from the Pittsfield works. They will average in sizes from 1,000 kw. to 5,000 kw. in capacity and will be for voltage as high as 66,000.

Anaconda Copper Advances Wages

The Anaconda Copper Mining Company has advanced miners' wages in the Butte district 50 cents a day, according to an announcement made last week. This is not the first advance in miners' wages announced in the copper industry since the beginning of the year, but it is the first action to be taken by one of the larger companies. It is expected that the advance by Anaconda will force other companies to announce a similar increase.

Marshall Moves to St. Louis

The Marshall Electric Company, Chicago, originator of the Marshall system of constant-potential charging for storage batteries, will move its offices to St. Louis March 26. It will occupy the second floor at 3225 Locust Street. Harry B. Marshall is president, D. P. Ruger vice-president, and Thomas Marshall treasurer.

Form Electric Club of Brooklyn

The Electric Club of Brooklyn has been incorporated with offices at 503 Myrtle Avenue, Brooklyn, N. Y. W. J. Shannon is president, D. M. Carr is vice-president, H. W. Bishop is treasurer, and A. Stone is secretary.

According to an announcement issued by the new club, its purposes are: "To foster trade or commerce for the interests of those having a trade, business, financial or professional interest in the electrical industry; to reform abuses relative thereto, and to secure freedom from unjust or unlawful exactions; to diffuse accurate and reliable information as to the standing of merchants or other matters; to procure uniformity and certainty in the customs and usage of trade and commerce and of those having a trade, business, financial or professional interest in the electrical industry; to settle differences between members, to promote a more enlarged and friendly intercourse between business in the electrical industry, and to enjoy as a corporation every right and privilege whatsoever to the fullest extent, pursuant to and in conformity with the acts of the Legislature of the State of New York relating to membership corporations."

Torrington Company's Changes in New York

The Torrington Company, Torrington, Conn., has opened up a Torrington shop at 9-11 East Thirty-seventh Street, New York City, which will also be the headquarters for its New York sales office, its Eastern division sales headquarters and its general sales office for the entire vacuum-cleaner business, which is in charge of C. M. Bunnell as general sales manager.

Charter Purchases Mietz Oil Engine Business

The Charter Gas Engine Company, Sterling, Ill., announces the purchase of the entire "Mietz" oil engine (also known as "Mietz & Weiss") business, heretofore carried on at 128 Mott Street and 430 East Nineteenth Street, New York City, by the August Mietz Corporation and the Reliance Oil Engine Corporation. This effects a merger and consolidation, under one management, of two of the oldest internal combustion engines in the world.

The "Mietz" oil engine was the pioneer semi-Diesel oil engine of the world. The first "Mietz" oil engine was built in 1895 by Mietz & Weiss, and since that time there has been placed in service about 375,000 hp. in all parts of the world.

The Charter Gas Engine Company is now moving from New York City to its plant at Sterling all of the physical assets comprising the "Mietz" engine and in the meantime is filling repair orders from New York City, so that there will be no interruption in repair service to "Mietz" engine users.

Despatch Appoints J. R. Eves

The Despatch Manufacturing Company, Minneapolis, manufacturer of electric ovens, has appointed J. R. Eves as its heating specialist and engineer to serve as the district manager in the Buffalo territory, at 81 Eighteenth Street.

Mine & Smelter Appointment

M. H. Carpenter, former manager of the San Francisco branch of the Mine & Smelter Supply Company, El Paso, Tex., electrical apparatus and supplies, has been appointed El Paso manager and will assume his new duties on April 1. Mr. Carpenter is well known to the mining trade of the West, having been with the Mine & Smelter firm for a number of years.

Benjamin Electric Sales Gain 25 per Cent

The 1922 financial report of the Benjamin Electric Manufacturing Company, Chicago, showed the improved condition of the company over 1921. The balance for Dec. 31, 1922, totaled $272,317.64, while that of Jan. 2, 1922, was $122,390.64.

President R. B. Benjamin's report said in part: "There was a marked improvement in business activity during 1922, sales for the year showing an increase of more than 25 per cent over those of 1921, which resulted in a net profit for the company of $203,723.94 This compares with a loss in 1921 of $643,374.38, largely due to depreciation of inventory. During the year our 8 per cent five-year serial gold notes were amortized by the sale of $1,500,000 6 per cent first-mortgage fifteen-year sinking-fund gold bonds, thus lowering the high interest rate and burdensome maturities." The surplus accounts for the year 1922 are as shown in the accompanying table.

Balance—Jan. 2, 1922		$122,390.64
Add: Profits for year		203,723.94
		$326,114.58
Deduct: Dividends paid and accrued—first preferred	$48,650.00	
Federal taxes paid	2,040.00	
Sundry adjustments	3,106.94	
		53,796.94
Balance, Dec. 31, 1922		$272,317.64

Standard Underground Cable Will Move to New Building in April

The Standard Underground Cable Company will move its general offices and Pittsburgh sales office from the Westinghouse Building, where it has been established for many years, to the company's new factory and office building at 100-108 Seventeenth Street early in April.

The new building is a four-story, brick-and-steel structure just completed and occupying the entire block between Sixteenth and Seventeenth Streets. This block was the site of the company's first factory, erected in 1883.

The Standard Underground Cable Company also announces the opening of a branch of its St. Louis sales office in the Scarritt Arcade Building, 817-819 Walnut Street, Kansas City. E. H. Shutt, who has been with the com-

pany for several years, will be in charge of the new office as district sales agent.

Order for 2,000 Distribution Transformers Goes to Westinghouse

The Southern California Edison Company has placed with the Westinghouse Electric & Manufacturing Company an order for 2,000 distribution transformers, amounting to approximately half a million dollars. The size of the contract, which is one of the largest ever placed for such apparatus, can be estimated by the fact that there are mor than thirty carloads of transformers in the order.

The transformers are to be used mainly for supplying power for motors for irrigating farm lands in southern California. This part of the state is dependent for practically all of its water supply upon wells, from which the water is pumped by electricity and distributed over the land in irrigation ditches, and for this reason the Southern California Edison Company is carrying out an extensive developmen of distribution lines throughout the territory which it serves.

Gibb Opens Cleveland Office

The Gibb Instrument Company, Bay City, Mich., manufacturer of electric equipment, has opened a sales office in Cleveland, at 2104 East Superior Avenue, which will be in charge of W. O. Little.

Storage Battery Firms Report $6,921,195 Profit from Sales

The Electric Storage Battery Company and the Willard Storage Battery Company, Philadelphia, in their consolidated balance sheet as of Dec. 31, 1922, show gross sales, less cost of manufacture, including all expenses incident thereto, of $11,966,681. Selling, administrative and general expenses, including salaries, commissions, engineering and branch office expenses, were $5,045,486. Profit from sales amounted to $6,921,195, and other income, $649,644. The listed profit before allowance for federal income tax was $7,570,834. Dividends paid during the year 1922 amounted to $3,196,685. The federal income tax for the year 1922 is estimated at $885,000.

Federal Electric's Gross Earnings Gained $657,994

For 1922 the Federal Electric Company, Inc., Chicago, showed a gain in gross earnings over 1921 of $657,994. The total income from all sources during 1922 was $4,997,775.98. After deducting manufacturing expenses, net interest on expenses, the net income for the year carried to surplus amounted to $80,365.66. There was charged off from the surplus account $215,610.64. Samuel Insull, chairman of the board, in his annual report explained this as follows:

"For many years the company has carried on its balance sheet, under the caption "deferred charges," an item principally made up of the original cost of developing its branch offices and the brokerage upon the sale of its preferred stock. It has now been deemed wise to begin to make some substantial reductions in this item, and you will note in the surplus account an item of $215,610.64, which means that this amount has been taken from the deferred charges and has been charged against the surplus of the company."

Monitor Controller Changes in Sales Organization

The Monitor Controller Company, Baltimore, manufacturer of the "just-press-a-button system" of automatic motor control for all kinds of motor-driven machinery, announces that C. J. Mundo has been appointed in charge of its Pittsburgh office in the Union Arcade Building, Pittsburgh.

G. H. Armstrong, who was formerly in charge of the Pittsburgh office, has been moved to Cincinnati with offices at 307 First National Bank Building. Mr. Armstrong's territory will comprise southwstern Ohio, southern Indiana and Kentucky.

William Ryle & Company, manufacturers of silk for electrical purposes, announce the removal of their office and salesroom to 381 Fourth Avenue, New York City.

Charles G. Schwartz, 217 Centre Street, New York City, manufacturer and dealer in electric motors, etc., has purchased the former seven-story plant of F. G. Smith, Inc., manufacturer of pianos, Fulton Street, Brooklyn, at a bankruptcy sale, for an amount of $47,000, and will use the factory for his business.

The Royal Electric Supply Company, 125 North Fourth Street, Philadelphia, has leased the building at 145-7 North Fourth Street for extensions in its business.

The Master Electric Company, Dayton, Ohio, announces the appointment of Herbert O. Sauer as sales service manager. Mr. Sauer's former experience has been in the advertising business with the National Cash Register Company.

The Jeannin Electric Company, Toledo, Ohio, manufacturer of motors, has appointed D. D. Gill, 712 Ferguson Building, Pittsburgh, as its representative in the western Pennsylvania and West Virginia territory.

The Howell Electric Motors Company, Howell, Mich., manufacturer of "Red Band" motors, recently opened a New York City office at 17 East Forty-second Street. R. W. Baker is in charge as district manager. A complete stock is now being carried in its New York City warehouse.

The Cummings Manufacturing Company, Indianapolis, manufacturer of battery boxes and kindred equipment, is moving into a new plant at 1118 South Harding Street, to provide for extensive increase in production.

Western Electric's Record-Breaking Year

Gross sales of the Western Electric Company in 1922 amounted to $210,941,000, a gain of $21,176,000 over 1921 and the largest volume of business in the company's history, according to the annual report of President Charles G. Du Bois. Of this volume, $158,614,000 was sold to the associated companies of the Bell System and $52,327,000 to others. The net earnings for the year amounted to $9,235,890, from which was paid interest and amortization of bond discount of $3,904,097 and dividends of $4,186,857, leaving a balance carried to common stock of $1,144,936. The net earnings amounted to 7.7 per cent on the average investment for the year.

A careful survey of the prospects, according to President Du Bois, indicates that the billings in 1923 will somewhat exceed those for 1922. The unfilled orders at the end of 1922 aggregated $62,000,000, a smaller figure than at the end of either of the two preceding years. This is due to the greater expedition in completion of orders on account of the company's larger manufacturing facilities.

During the year the company paid off $15,000,000 of first mortgage bonds by funds secured from the sale of 150,000 shares of common stock to its common stockholders. It called for redemption its issue of $28,600,000 of 7 per cent convertible bonds. The holders of $24,679,600 worth of these bonds converted into the company's 7 per cent preferred stock, and the balance was paid off at 102. This preferred stock is owned by 8,698 shareholders, the average holding being twenty-eight shares. The company's financial position has been still further improved by reducing the bills payable from $29,050,000 to $12,000,000. Current assets and current liabilities are both somewhat less than at the end of the previous year, leaving the net working capital substantially the same at $70,469,326.

During 1922 the economic and industrial condition in foreign countries with few exceptions showed little or no improvement. Notwithstanding adverse conditions, the sales of the International Western Electric Company, which conducts the export and foreign business of the Western Electric Company, were in 1922 approximately $35,000,000 reckoned at current rates of exchange. This figure includes the sales of the principal foreign affiliated companies.

New Incorporations

THE MORGANTOWN ELECTRIC COMPANY, Bowling Green, Ky., has been organized by Dr. A. M. Rowe, L. C. Alderson and H. W. Sublett.

THE CUMBERLAND HYDRO-ELECTRIC POWER COMPANY, Frankfort, Ky., has been chartered with a capital stock of $100,000 by Charles H. Morris, Frankfort; Samuel A. Tescher and Harny A. Mansfield, both of Indianapolis, Ind.

THE ELKTON (MD.) ELECTRIC COMPANY, INC., has been incorporated by John H. Ware, Jr., Phillip H. Close and Roy F. Simons. The company is capitalized at $100,000 and proposes to acquire and operate properties of Gilpins Falls Hydro-Electric Trust Estate.

THE RIPLEY (MISS.) ELECTRICAL LIGHTING & POWER CORPORATION has been chartered with a capital stock of $15,000 by Charles T. Nelms, Lee Cox and T. C. Hines.

Foreign Trade Notes

AUTOMATIC TELEPHONES BEING CONSIDERED FOR JESSELTON, BORNEO.—The installation of automatic telephones in Jesselton, British North Borneo, according to *Commerce Reports*, is under consideration.

RADIO TELEGRAPH STATIONS FOR AMAZON VALLEY, BRAZIL.—Credit for the purpose of acquiring fourteen radio receiving stations, *Commerce Reports* states, has been asked by the Brazilian Minister of Transportation and Public Works. It is proposed to install these stations, which will be equipped with audion receivers and low-frequency amplifiers, in the States of Acre and Amazonas.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in South Africa (No. 5,777) of electric meat choppers and other supplies for butchers, dairy utensils and weighing apparatus.

An agency is desired in Brazil (No. 5,791) for electric welding machinery.

EQUIPMENT FOR POWER PLANTS WANTED IN CHINA.—Electric generating machinery to furnish electricity in ten towns in the Antung, China, consular district, *Commerce Reports* states, is desired by a Chinese firm, which is reported to have contracts to install these plants. The capacities of the proposed plants range from 11 kw. to 110 kw., or sufficient to supply 700 to 5,000 16-cp. lamps. The firm wishes to act as agent for an American manufacturer who desires representation in the district tributary to Antung. Further particulars may be obtained from the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., or district offices by referring to file No. 85,923.

EQUIPMENT FOR THE MANGAHAO POWER SCHEME, NEW ZEALAND.—Tenders will be received by the Public Works Department, Wellington, New Zealand, until May 29 for two petrol engines, generators and accessories and six single-phase transformers in connection with the Mangahao electric power scheme. Tenders will also be received until May 1 for oil filtering and testing sets in connection with the Mangahao project.

ELECTRIC CRANES FOR ANTWERP, BELGIUM.—Tenders will be received by the municipality of Antwerp for fifteen 2½-ton electric cranes for use at the Bassin Canal, Antwerp. Each crane to be provided with four motors, operating on direct current at 550 volts.

HIGH POWER WIRELESS STATION FOR AUSTRALIA.—Tenders will be received by the Amalgamated Wireless (Australia), Ltd., 97 Clarence Street, Sydney, Australia, until April 30 for furnishing and erecting a high-power duplex station within 100 miles of Sydney or Melbourne, capable of direct communication with England. Suitable corresponding stations to be provided in England and Canada.

POWER STATION FOR CHANGCHOW, CHINA.—A power station is being erected at Changchow, China, at a cost of $500,000, by the Chen Hwa Electric Company.

BRONZE AND COPPER WIRE FOR AUSTRALIA.—Tenders will be received by the Postmaster-General's Department, Australia, until April 10 for 700 tons of bronze wire and 1,900 tons of copper wire for the Post and Telegraph Department. Specifications and tender forms may be obtained of D. B. Edwards, official secretary, in charge of the office of the Australian Commissioner, 44 Whitehall Street, New York City.

New Apparatus and Publications

WATER SOFTENER.—Bulletin No. 509 distributed by the Graver Corporation, East Chicago, Ind., describes the Graver "Zeolite" water-softening equipment.

THERAPEUTIC LAMP.—A new therapeutic lamp, known as "Q-Ray," has recently been placed on the market by S. Robert Schwartz & Brother, 546 Broadway, New York City.

ENTRANCE SWITCH.—The Palmer Electric & Manufacturing Company, 175 Fifth Street, Cambridge, Mass., has recently placed on the market a new type of entrance switch, known as the "Universal" meter-service switch.

CENTRIFUGAL PUMPS.—Bulletin No. 1,632-F issued by the Allis-Chalmers Manufacturing Company, Milwaukee, describes and illustrates its centrifugal pumps and centrifugal pumping units for power plants, waterworks and industrial plants.

AUTOMATIC TIME SWITCH.—An automatic time switch for henneries, known as the "Cackle" time switch, is being distributed by A. Hall Berry, 73 Murray Street, New York City.

ELECTRIC CLEANER.—The Hoover Suction Sweeper Company, North Canton, Ohio, has developed a new electric cleaner, household size, known as model No. 541.

ELECTRIC ELEVATING TRUCK.—The Cowan Truck Company, 80 Water Street, Holyoke, Mass., is distributing a leaflet, covering its new model "LLT" electric elevating truck.

ELECTRIC DISHWASHER.—An electric household dishwasher, "Hydrola," is being manufactured by the Hydrola Dishwasher Company, Hillsdale, Mich.

ELECTRIC TRAFFIC SIGNALS.—A bulletin describing three electrical directing traffic markers is being distributed by the Traffic Control, Inc., Milwaukee.

STEAM TURBINES.—"De Laval Equipment in a Textile Mill" is the title of a bulletin issued by the De Laval Steam Turbine Company, Trenton, N. J., which describes the use of low-pressure steam in a manufacturing plant for process purposes supplied from a turbine of special design.

LUMBER REGISTER.—The Industrial Service Company, Alisky Building, Portland, Ore., has issued a complete directory of the lumber industry and allied industries of the Northwest. It contains more than 6,400 names and indicates the type of mill and machinery it is equipped with, and also whether the power used is steam or electricity.

FACTORY BUILDINGS.—The Austin Company, Cleveland, has published a booklet entitled "Multi-Story or Single-Story—Which?" in which a comparison of the relative advantages and disadvantages of multi-story and single-story factory buildings is made.

RANGE BOILER COVER.—A new range boiler cover for use in connection with the "A & F" and other electric water heaters has been developed by the Arthur & Fowler Company, Spokane, Wash. The Washington Electric Supply Company, South 132 Monroe Street, Spokane, Wash., is distributor.

MOTOR DRIVE FOR AMMONIA COMPRESSORS.—"Synchronous Motor Drive for Ammonia Compressors" is the title of bulletin No. 41,316 issued by the General Electric Company, Schenectady, N. Y., which gives a brief treatment of the development of ice-making machines with suggestions as to the trend of progress.

INSULATION.—The Mica Insulator Company, 68 Church Street, New York City, has developed an insulation, known as "Armatite," which is made for all insulating and protective purposes.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

MILO, ME.—The Milo Electric Light & Power Company has petitioned the Public Utilities Commission for permission to purchase the property and holdings of the Sebac (Me.) Dam Company.

BOSTON, MASS.—The Edison Electric Illuminating Company plans to build an addition to its substation No. 12, on Chatham Street.

CAMBRIDGE, MASS.—Additions will be made to the power plant of the Atheneum Press, Ginn & Company, within the next year, which will include the installation of a 500-kw., 125-volt direct-current generating set. G. H. Kimball is superintendent of power department.

WORCESTER, MASS.—The New England Power Company has applied to the Department of Public Utilities for authority to issue $3,000,000 in capital stock, the proceeds to be used for the erection of transmission lines from Adams to Pittsfield, for construction work at Davis Bridge, N. H., and for other extensions and improvements.

PROVIDENCE, R. I.—The Narragansett Electric Lighting Company contemplates the construction of a new switch house, to cost about $1,000,000.

SOUTH NORWALK, CONN.—Extensions to the municipal electric plant, to cost about $300,000, are under consideration.

Middle Atlantic States

BUFFALO, N. Y.—The Superior Elevator Company will install electric power equipment in connection with extensions to its grain elevator on the Buffalo River, to cost about $275,000.

CHATHAM, N. Y.—The Chatham Electric Light, Heat & Power Company has applied to the Public Service Commission for a franchise to extend its transmission line to Nassau through the villages of Brainard and East Nassau.

FILLMORE, N. Y.—Extensions and improvements contemplated by the Genesee Valley Power Company this spring include the erection of a 13,200-volt transmission line from East Koy to Portageville, the installation of a second 750-kva., 13,200-volt transformer bank, a second high-voltage lightning arrester and making several changes in the switching equipment at the outdoor substation at the Wiscoy hydro-electric plant. H. G. Young is superintendent.

HOOSICK FALLS, N. Y.—Plans are under consideration by the Board of Trustees for the installation of an ornamental lighting system.

NEW YORK, N. Y.—The United Electric Light & Power Company plans to build an electric generating plant on Locust Avenue, near 139th Street, Bronx, to cost about $800,000. Thomas E. Murray, 55 Duane Street, is engineer.

NEW YORK, N. Y.—The New York Edison Company will build a substation on Canal Place near 140th Street, to cost about $250,000. William Whitehall, 709 Sixth Avenue, is architect.

UTICA, N. Y.—Electric power equipment will be installed in the proposed new ice-manufacturing and ice-cream plant of the Dairyman's League Co-operative Association, 222 Lafayette Street, to cost about $100,000.

WATERVLIET, N. Y.—The London Steam Turbine Company, 50 Church Street, New York, plans to build a power house at its proposed plant for the manufacture of engines, to cost about $150,000.

MORRISTOWN, N. J.—The Central Jersey Power & Light Company, recently organized with a capital of $2,000,000, has acquired the Commonwealth Electric Company and the Morris & Somerset Electric Company and will merge the properties. Extensions and improvements are contemplated.

HANOVER, PA.—The Metropolitan Edison Company has issued $1,000,000 in bonds, the proceeds to be used to acquire the

Hanover Power Company and its subsidiary organizations, and for proposed extensions and improvements.

MARTIN'S CREEK, PA. — The Alpha Portland Cement Company and not the Atlas Portland Cement Company, as stated in these columns last week, will make extensions and improvements in the power plant at its local mills.

McKEE'S ROCKS, PA.—The W. L. Singer Ice Company plans to rebuild its power house, recently damaged by fire, including ice department, causing a loss of about $75,000.

PHILADELPHIA, PA. — Electric power equipment will be installed in the proposed addition to the plant of Stephen F. Whitman & Son, Inc., 415 Race Street, to cost about $500,000.

PHILADELPHIA, PA.—The Philadelphia & Reading Railroad Company will build a power plant in connection with its proposed car dumper at Port Richmond, to cost about $1,500,000.

READING, PA.—The plant of the Reading Ice & Cold Storage Company will be equipped for electrical operation throughout, at a cost of about $90,000.

CUMBERLAND, MD. — The West Penn Power Company contemplates extensions and improvements to the system of the Edison Electric Illuminating Company, recently acquired.

HAGERSTOWN, MD. — The Maryland Glass Sand Company is planning to install a power plant at its works near Hancock and to equip all departments for electrical operation.

FRANKLIN, W. VA.—Plans are being prepared for the construction of a municipal electric plant on the South Branch of the Potomac River.

HUNTINGTON, W. VA.—Bids will be received by the United State Engineer Office until March 27 for two switchboards (Circular 104).

NORTH EMPORIA, VA. — The Little-Dewey Veneer Company contemplates the construction of a power house at its proposed local mill.

STUART, VA.—W. H. Clark, owner of the local electric plant, is in the market for an 80-kw. electric generator set, with auxiliary machinery.

SUFFOLK, VA.—The ice and cold-storage plant of N. R. Withers is being remodeled. The entire plant will be equipped with electrically driven machinery. Henry B. Reardon, Jr., Norfolk, is consulting engineer.

WASHINGTON, D. C.—Bids will be received by the Commissioners of the District of Columbia, District Building, until March 28 for furnishing and installing an electric time and bell system in the Shaw Junior High School.

WASHINGTON, D. C.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until April 5 for furnishing watt-hour meters, motors, steel conduit, Pierce pins, receptacles, sockets, white hard-horn fiber, varnished silk, spark plugs, vacuum tubes, etc.

North Central States

DETROIT, MICH. — The Ford Motor Company will build a generator plant at its factory, to cost about $45,000, exclusive of machinery.

JACKSON, MICH.—The Michigan Seating Company will build a power house, 75 ft. by 130 ft. at its plant.

MARYSVILLE, OHIO.—Bids will be received by the Department of Public Welfare, Ninth and Oak Streets, Columbus, until April 4 for construction of cottage, to cost $150,000; superintendent cottage, $35,000, and power plant and chimney, $20,000, at the Reformatory for Women at Marysville.

WARREN, OHIO. — The Ohio Public Service Company has issued $2,675,000 in bonds, part of the proceeds to be used for extensions.

CHINNVILLE, KY.—The Kentucky Refractories Company, Ironton, contemplates the construction of a power house in connection with its proposed local refractory plant, to cost about $80,000.

LOUISVILLE, KY.—The Louisville Gas & Electric Company contemplates extensions and improvements to its hydro-electric plant at Ohio Falls.

OWENSBORO, KY.—Bolger & Medley plan to install a power house in connection with a new brick and tile products plant, to cost about $65,000.

INDIANAPOLIS, IND.—The Indianapolis Light & Heat Company is planning extensions and improvements during the present year involving an expenditure of about $1,250,000. The proposed work will include the installation of a 27,000-hp. turbine with boilers, condensers and the erection of a large smokestack at the Kentucky Avenue power station; installation of a storage battery and direct-current motor-generator sets in substation in the rear of central offices; installation of new cables in conduits in the downtown business district; installation of copper cables, both aërial and underground; construction of an 8,000-hp. substation at Speedway City, and a substation at Keystone Avenue and the L. E. & W. railroad to furnish electricity for lamps and motors for Broad Ripple district.

JASPER, IND.—Work will begin at once on improvements to the municipal power plant, to cost about $60,000. J. R. Lowe, 111 Third Street, Louisville, Ky., is consulting engineer.

KOKOMO, IND. — The Public Service Commission has authorized the Northern Indiana Power Company to issue $218,000 in capital stock and $470,000 in bonds, the proceeds to be used for improvements, including the erection of a transmission line from Kokomo to Converse, from Kokomo to Noblesville and from there to Sheridan. Improvements will be made to the substations at Kirklin, Noblesville, Kokomo and other places.

MARSEILLES, ILL. — Electric power equipment will be installed in the proposed baking plant to be erected by the National Biscuit Company, to cost about $500,000. A. G. Zimmerman, 85 Ninth Avenue, New York, is architect.

GREEN BAY, WIS.—The installation of ornamental lamps in Bay View Beach Park, Whitney Park and possibly other parks is under consideration.

WABENO, WIS.—The Wabeno Lighting Company contemplates improvements to its plant, including the installation of a new engine.

WAUSAU, WIS.—The Wisconsin Valley Electric Company contemplates installing a new generator and turbine at its Jersey City power plant.

WHITEWATER, WIS.—Plans are under way by the Wisconsin Gas & Electric Company, Racine, for the erection of a 132,000-volt transmission line from the new generating plant of the Milwaukee Electric Railway & Light Company on the lake shore to Whitewater. A site on South Franklin Street has been acquired for the substation.

WILLMAR, MINN.—Plans are being prepared for a municipal electric power plant, to cost about $100,000. Cory & Lecoco, Aberdeen, S. D., are engineers.

CEDAR RAPIDS, IOWA. — The Iowa Railway & Light Company is planning to erect a 33,000-volt transmission line between Boone and Nevada, 24 miles. The proposed line will also connect up the generating stations at Cedar Rapids, Boone and Perry.

FORT MADISON, IOWA.—Improvements are contemplated by the Fort Madison Electric Company, involving an expenditure of about $50,000.

KANSAS CITY, MO.—The Council is considering the construction of a new fire house, the purchase of fire-alarm equipment, underground cables and equipment, etc., to cost about $216,000.

LAKE NORDEN, S. D.—Steps have been taken by business men of Lake Norden and Hayti to secure an improved lighting system for both towns. The question of having transmission lines extended to the towns is under consideration.

ELMDALE, KAN. — A special election will be held on April 2 to vote on the proposal to issue $12,000 in bonds for the erection of a transmission line from Cottonwood Falls to Elmdale.

FREDONIA, KAN.—At an election held recently the proposal to issue $150,000 in bonds for the installation of a municipal electric light plant was carried.

TOPEKA, KAN.—The Ismert & Hincke Milling Company, Washington and Tenth Streets, plans to build a power house in connection with other plant extensions.

WICHITA, KAN.—Bids, it is reported, will soon be asked by the city manager for the installation of a new fire-alarm system, to cost about $60,000.

Southern States

GREENSBORO, N. C.—Plans are being prepared for the installation of ornamental lamps on portions of Market and Washington Streets. The street-lighting service is furnished by the North Carolina Public Service Company.

CHARLESTON, S. C.—The F. P. Burton Lumber Company plans to rebuild its power house and mill, recently destroyed by fire with loss of about $400,000.

AUSTELL, GA.—Plans for the proposed chair-manufacturing plant to be erected by Charles J. Shelverton and associates include a power plant.

ROME, GA.—Electric power equipment will be installed in the proposed addition to be erected at the Berryton Cotton Mills, to cost about $160,000.

GAINESVILLE, FLA.—A bond issue of $300,000 is being arranged for extensions to the municipal power plant and waterworks and sewerage system.

MIAMI, FLA.—The Coral Gables Utilities Company, recently organized with a capital stock of $500,000, has tentative plans for the construction of a power plant and system. George E. Merrick is president.

SEBRING, FLA.—Plans are under consideration for extensions and improvements in the municipal light and water plant, recently acquired from the Sebring Light & Water Company.

CHATTANOOGA, TENN.—The Tennessee Electric Power Company is preparing plans for a 20,000-hp. hydro-electric plant at Grand Falls. It is also proposed to build a 27,000-hp. steam-operated electric plant at Hales Bar. The cost of the plant is estimated at about $3,000,000.

KNOXVILLE, TENN.—The Knox Porcelain Company, recently organized will install a power plant in connection with its proposed local works for the manufacture of electrical porcelain specialties. J. N. House is president.

ROCKWOOD, TENN.—The Roane Iron Company, Chattanooga, plans to build a power plant at its local ironworks. The equipment will include a 1,500 kw. turbo-generator.

EUTAW, ALA.—A bond issue of $45,000 has been sold, the proceeds to be used to establish a municipal lighting plant and waterworks.

TUSKEGEE, ALA.—The West Memphis Lumber Company, Memphis, Tenn., plans to build a power plant at its proposed local lumber mill, to cost about $100,000.

HERMITAGE, ARK.—M. C. Sanders is organizing a company to construct and operate a power plant for local service.

ALEXANDRIA, LA.—The Missouri Pacific Railroad Company and the Texas Pacific Railroad Company, St. Louis, Mo., plan to build a power house in connection with new joint shops, to cost about $1,000,000.

NEW ORLEANS, LA.—The Todd Shipyards Corporation, 25 Broadway, New York, will build a power house in connection with its proposed drydock and shipbuilding plant, to cost about $3,000,000.

HELENA, OKLA. — Extensions to the municipal electric distribution system are under consideration. J. D. Bomford, Masonic Temple Building, Enid, is engineer.

PAULS VALLEY, OKLA.—Plans have been completed and bids, it is understood, will be called at once for the construction of a transmission line for municipal service. V. V. Long & Company, 1300 Colcord Building, Oklahoma City, are engineers.

BYERS, TEX.—Steps have been taken by the Chamber of Commerce for a municipal lighting plant and ice-manufacturing plant.

CHILDRESS, TEX.—The Texas Central Power Company has authorized plans for the construction of electric power plants, with ice-manufacturing plants adjoining, at Childress, Vernon and Beeville. The total cost is estimated at $225,000.

DALLAS, TEX.—The Dallas Mill Company, recently organized with a capital stock of $1,000,000, plans to build a power plant in connection with its cotton mill, to be erected on the Love Aviation Field.

DALLAS, TEX.—Plans are under consideration by the St. Louis & Southwestern Railroad Company, known as the Cotton Belt Railroad, Cotton Belt Building, and the Texas Electric Railroad Company for equipping the railroad from Plano to Greenville for electrical operation. The cost is estimated at about $600,000. J. G. Hailey is electrical engineer of the Texas Electric Railroad.

DEL RIO, TEX. — The Texas Central Power Company is planning to reconstruct its local distribution system this summer.

EL PASO, TEX.—Plans are under way for the installation of an ornamental lighting system in the business district.

ENNIS, TEX.—Plans have been approved for a municipal electric plant, to cost $50,000, for which, it is understood, bids will soon be asked.

FORT WORTH, TEX.—The Trinity & Brazos Valley Railroad Company contemplates the construction of a large substation

in connection with the electrification of its line from Hillsboro to Cleburne, to cost about $150,000.

HARLINGEN, TEX. — Negotiations are under way between E. B. Neiswanger and associates for the purchase of the municipal electric plant. If the deal goes through a new central station will be built. The proposal to sell the plant will be submitted to the voters on April 10.

KOSSE, TEX.—The Kosse Light & Power Company contemplates extensions and improvements to its system. Its capital stock has been increased from $12,000 to $25,000.

SMITH'S BLUFF, TEX.—The Humphreys-Pure Oil Company, Pure Oil Building, Columbus, Ohio, plans to build a power plant in connection with a local oil refinery, to cost about $2,500,000.

TERRELL, TEX.—The Texas Power & Light Company, Dallas, is extending its high-tension transmission line from Terrell to Wills Point, a distance of 12 miles.

WACO, TEX.—The Waco Lime & Products Company, recently organized, contemplates the construction of a new local plant, including power house, to cost about $125,000. B. F. Litsinger is president.

WILLS POINT, TEX.—An election will be held on April 3 to vote on the proposal to issue $25,000 in bonds to establish a municipal electric light light and power plant.

Pacific and Mountain States

PROSSER, WASH.—The installation of a municipal electric plant is under consideration.

SEATTLE, WASH.—Bids will be received by the city of Seattle until April 13 for the erection of 100 miles of 165,000-volt transmission line and telephone line from the Gorge Creek plant of the Skagit River development. The line will transmit power from the Gorge Creek plant to a substation outside of the city. Specifications will be complete March 30. Further information may be obtained at the office of the Skagit River Development, Alaska Building. C. F. Uhden is chief engineer.

VANCOUVER, WASH. — The Clarke County Water, Light & Power Company, recently organized, is having plans prepared for a transmission system for service at Sifton, Battle Ground, Brush Prairie, Orchards and vicinity, to cost about $50,000.

VANCOUVER, WASH.—A new substation (to cost about $50,000) is being erected here by the Northwestern Electric Company, Portland, Ore. The company also plans to erect a 66,000-volt transmission line from Camas to Vancouver, to cost about $75,000.

VERNONIA, ORE.—The Vernonia Light & Power Company has begun preliminary work on the erection of its electric distribution system within the city limits. Work will soon begin on the construction of the dam in Rock Creek, about 9 miles from here.

HUNTINGTON BEACH, CAL. — Plans are under consideration for the installation of a lighting system on the state highway, to cost about $20,000.

LOS ANGELES, CAL.—Bids will be received by the Public Service Commission until March 27 for potential transformers and current transformers (Spec. P-306-350).

MODESTO, CAL.—The Modesto Irrigation District plans to erect electric substations, transmission and distributing lines to cost about $300,000. Percy Jones is chief engineer.

SAN FRANCISCO, CAL.—Arrangements are being made for the installation of a third generating unit of 22,000 kw. capacity in the Caribou plant on the North Fork of the Feather River of the Great Western Power Company of California. Bids will soon be called for hydraulic and electrical equipment. The cost is estimated at about $1,500,000.

SAN FRANCISCO, CAL.—Work will soon begin on the second of the chain of power houses on the Pit River to be erected by the Pacific Gas & Electric Company, which will ultimately develop more than 600,000 hp. The plant which will be known as Pit River plant No. 3, will be equipped with three 27,000 kva. units and will cost about $17,000,000. The plant will operate under a static head of 313 ft. The plant will be located about 12 miles below Pit River No. 1 and will involve construction of a diversion dam 125 ft. high and a tunnel 22,000 ft. in length, having a carrying capacity of 3,000 cu.ft. per second.

PHOENIX, ARIZ.—An additional 7,500-kw. generating unit will be installed at the hydro-electric plant at the Roosevelt Dam on Salt River by the Salt River Valley Water Users' Association. Nineteen control gates will be added in the spillways of the dam, and another dam and power house will be built further down the river to control the release of water for irrigation to permit of higher load factor on the present plant at the dam. The Water Users' Association will issue $1,800,000 in bonds for financing the project.

BUTTE, MONT.—Arrangements are being made by the Montana Power Company to begin work on the construction of its Mystic Lake hydro-electric plant. The purposed plant will be located in the gorge of the Rosebud River, in the Beartooth Mountains, 43 miles from Columbus, and will have a capacity of 15,000 hp.

COLORADO SPRINGS, COL.—The City Council has passed an ordinance providing for the installation of an ornamental street-lighting system on East Platte Avenue, to cost about $17,528.

GOLDEN, COL.—The City Council has granted the Golden Cycle Mining Company permission to erect an electric transmission line from the Pikeview mine to the mill on the West Side.

Canada

ST. JOHN, N. B.—The installation of a new lighting system, to cost about $79,000, has been recommended to the City Council by B. Wilson, electrical engineer.

STOUFFVILLE, ONT.—The ratepayers have approved a bylaw appropriating $11,000 to secure Hydro power from Bond Lake.

THOROLD, ONT.—The purchase of a switchboard and lead-covered cable is contemplated by the Public Utilities Commission.

TIMMINS, ONT.—The Northern Canada Power Company is planning to build a fourth hydro-electric plant on the Mattagami River at Kenogamissee Falls, to develop 5,000 hp. under a 70-ft. head. The cost including transmission line is estimated at $750,000.

WOODSTOCK, ONT.—Extensions to the municipal electric light and power system, to cost about $25,000, are under consideration by the Public Utilities Commission.

Electrical Patents

Announced by U. S. Patent Office

(Issued Feb. 27, 1923)

1,447,107. ELECTRIC HEATER; E. A. Umble, Denver, Col. App. filed May 2, 1921. Heating metallic objects by immersion liquid.

1,447,134. PROTECTIVE DEVICE FOR ELECTRIC FLATIRONS; W. T. Hoofnagle, Glen Ridge, N. J. App. filed Feb. 10, 1921. Fusible plug opens circuit of predetermined temperature.

1,447,140. PROCESS OF EXTRACTING PRECIOUS METALS; C. C. McBride, Sanger, Cal. App. filed April 23, 1921. By electrolytic process.

1,447,143. MANUFACTURE OF LEAD ALLOYS; W. Mathesius, Charlottenburg, Germany. App. filed Oct. 21, 1922. Alkaline earth metals produced by electrolyzing their fused salts.

1,447,163. COMMUTATING MEANS FOR DYNAMO-ELECTRIC MACHINES; F. T. Hague and O. Needham, Pittsburgh, Pa. App. filed March 9, 1918. Neutralizing transformer electromotive forces produced by exciting field.

1,447,164. MULTIPLE WINDING FOR ALTERNATING-CURRENT MACHINES; F. T. Hague, Pittsburgh, Pa. App. filed Jan. 16, 1919. For low-voltage, high-current alternating-current generators.

1,447,165. RADIO METHOD AND APPARATUS; F. A. Kolster, Washington, D. C. App. filed Jan. 30, 1919. Directional sending and receiving apparatus.

(Issued March 6, 1923)

1,447,171. SWITCH; R. B. Benjamin and E. A. Detrick, Chicago, Ill. App. filed June 21, 1915. Full switches for lamp sockets.

1,447,172. ELECTRICAL SWITCH; R. B. Benjamin, Chicago, Ill., and T. H. Harris, Dayton, Ohio. App. filed Sept. 11, 1917. Pull switch for electric light fixtures.

1,447,181. HEATING PAD; W. Richmond, Chicago, Ill. App. filed March 26, 1920. Thermostatically controlled pad for treating mastoid or sinus conditions.

1,447,194. THERMAL CONTROLLER FOR ELECTRIC MOTORS AND THE LIKE; J. R. White, Washington, D. C. App. filed July 3, 1919. Rheostat contact arm consists of a spring held in place by magnet when circuit is closed.

1,447,204. PLURAL MODULATION AND DEMODULATION CITCUITS; L. Espenschied, Queens, N. Y. App. filed Sept. 30, 1919. Multiplex transmission of radio signals.

1,447,214. RADIATOR HEATER; J. A. Kurrus, East St. Louis, Ill. App. filed June 14, 1921. Small electric heater for automobile radiators to prevent freezing of water.

1,447,236. MAGNETIC REPULSION OR ATTRACTION RELAY; C. H. Chaney, Detroit, Mich. App. filed Dec. 15, 1920. Automatic regulator for electric furnaces.

1,447,238. LIGHTING FIXTURE; D. Crownfield, Cambridge, Mass. App. filed Dec. 3, 1919. Double reflectors used for diffused lighting.

1,447,241. ELECTRICAL SYSTEM FOR AUTOMOBILES; G. Fornaca, Turin, Italy. App. filed Jan. 12, 1920. Motor-generator for automobiles.

1,447,282. GENERATOR; L. A. Darling, Philadelphia, Pa. App. filed April 30, 1919. Turbo-generator unit for steam locomotives.

1,447,318. BATTERY-CHARGING SYSTEM; A. H. Neuland, Jersey City, N. J. App. filed Dec. 17, 1917. Automobile battery-charging system.

1,447,357. FLEXIBLE ELECTRODE; D. B. Price, Newtonville, Mass. App. filed Feb. 13, 1920. Non-corrosive terminals for storage batteries.

1,447,359. VENTILATED LINE INSULATOR; L. Steinberger, Brooklyn, N. Y. App. filed Nov. 26, 1918. A point midway between supporting pin and line.

1,447,399. DEVICE AND METHOD FOR MAKING STEREOSCOPIC X-RAY PICTURES; L. W. Pease, Chicago, Ill. App. filed June 6, 1919. Arrangement of special film plate.

1,447,405. LENS RING; E. R. Barany, Brooklyn, N. Y. App. filed July 26, 1922. For flashlight cases.

1,447,430. SCREEN FOR X-RAY PHOTOGRAPHY; G. W. Richardson, Chicago, Ill. App. filed Feb. 27, 1919.

1,447,464. STARTING DEVICE FOR INTERNAL-COMBUSTION ENGINES; E. Friedrichs, Stuttgart, Germany. App. filed Aug. 11, 1921.

1,447,477. ELECTRICAL STARTER FOR EXPLOSIVE ENGINES; G. K. Knapp, Nuremberg, Germany. App. filed Oct. 11, 1920.

1,447,480. ELECTRIC SYSTEM; S. J. Matthews, Fort Clinton, Ohio. App. filed March 7, 1917. Small plant for lighting, heating, power, etc.

1,447,481. THERMIONIC VALVE; H. Morris-Airey and G. Shearing, Portsmouth, and S. R. Mullard, Southfield, London, England. App. filed Aug. 22, 1921. Conductor and seal for thermionic valve.

1,447,509. TELEPHONE METERING SYSTEM; A. M. Crichton, Uniontown, Pa. App. filed April 13, 1920. Meter on subscriber's instrument must be partially actuated before getting central.

1,447,517. AUTOMATIC TEMPERATURE-CONTROL MEANS FOR ELECTRIC FURNACES; T. A. Reid, East Orange, N. J. App. filed Aug. 6, 1920. Thermocouple inserted in the furnace maintains through suitable apparatus predetermined temperature.

1,447,531. REVOLVING TELEPHONE STAND; E. F. Carlson, Brooklyn, N. Y. App. filed Nov. 3, 1921. Compact arrangement of a number of telephones on one stand.

1,447,532. GAS IGNITER; H. S. Cederholm, Wellington, New Zealand. App. filed March 3, 1921. Fine platinum wire heated by small battery.

1,447,570. SYSTEM OF CONTROL OF ELECTRICAL CIRCUITS; W. H. Powell, Milwaukee, Wis. App. filed April 22, 1918. Control of armature reaction for booster rotary converters.

1,447,574. ELECTRIC TOASTER; E. A. Rutenber, Milwaukee, Wis. App. filed March 28, 1922. Automatically turns bread when side is lowered.

1,447,593. FURNACE; W. R. Macklind, Chicago, Ill. App. filed Jan. 24, 1920. Continuous rotary furnaces, for treating lithopone.

1,447,646. SELENIUM CELL OR BRIDGE; C. W. Cherry, Boston, Mass. App. filed April 13, 1922. Large active surface area provided.

1,447,657. ELECTRODE FOR ALKALINE STORAGE BATTERIES; P. G. and E. Roesel, Paris, France. App. filed Sept. 14, 1920.

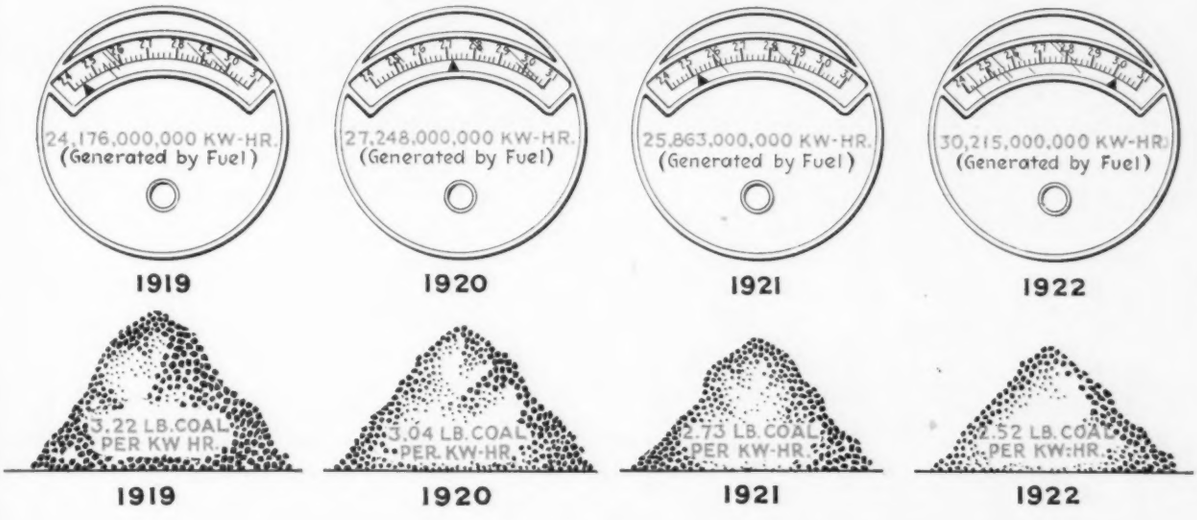
1,447,730. ELECTRIC WRITING INSTRUMENT; C. R. Post, New Rochelle, N. Y. App. filed Nov. 24, 1920. Electrical heated stylus for check or document writing.

1,447,747 AND 1,447,748. METHOD OF AND APPARATUS FOR OPERATING SYNCHRONOUS TELEGRAPH SYSTEM; G. R. Benjamin, Jersey City, N. J. App. filed Aug. 8, 1919. Automatic cable transmitters for synchronous printing telegraph systems.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

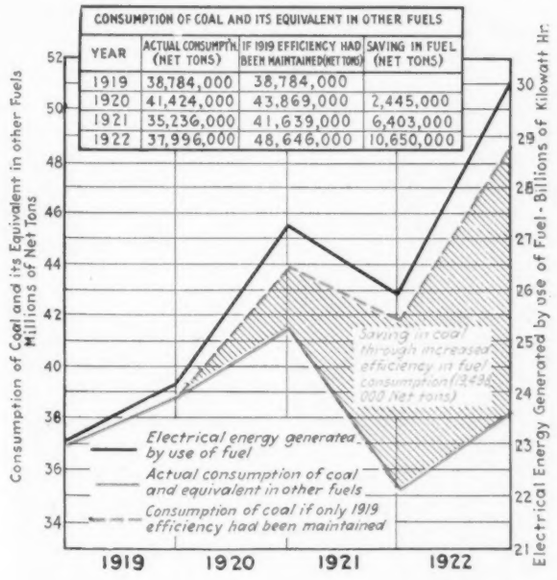
19,498,000 Net Tons of Coal Saved in Three Years by Central Stations Through Increased Efficiency in Fuel Consumption



Increased Efficiency In Fuel Consumption Saved Central Stations $92,128,000 In Three Years

CONSUMPTION OF COAL AND ITS EQUIVALENT IN OTHER FUELS

YEAR	ACTUAL CONSUMPTN (NET TONS)	IF 1919 EFFICIENCY HAD BEEN MAINTAINED (NET TONS)	SAVING IN FUEL (NET TONS)
1919	38,784,000	38,784,000	
1920	41,424,000	43,869,000	2,445,000
1921	35,236,000	41,639,000	6,403,000
1922	37,996,000	48,646,000	10,650,000

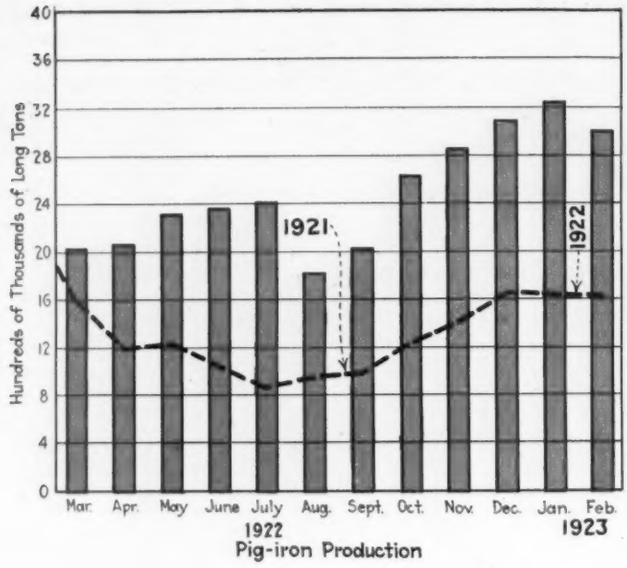

Consumption of Coal and its Equivalent in other Fuels Millions of Net Tons
Electrical Energy Generated by use of Fuel - Billions of Kilowatt Hr.
Saving in coal through increased efficiency in fuel consumption (2,438,000 net tons)
Electrical energy generated by use of fuel
Actual consumption of coal and equivalent in other fuels
Consumption of coal if only 1919 efficiency had been maintained
1919
1920
1921
1922

An Accomplishment in Increased Efficiency

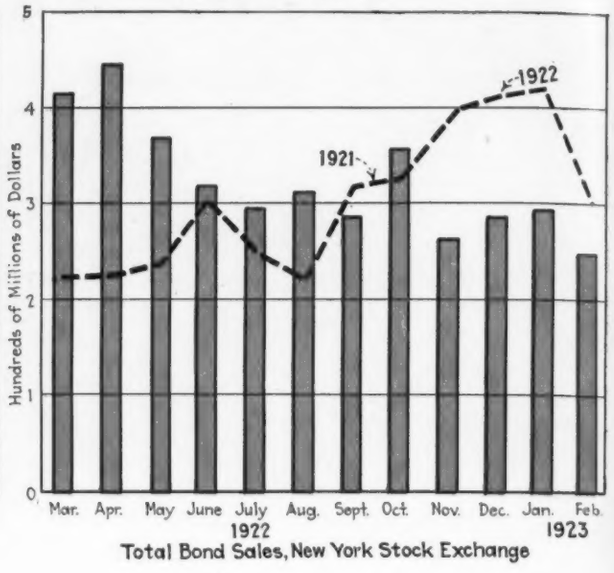
EFFICIENCY of operation is one of the prime essentials of modern industry, and the elimination of waste has become the great problem of the engineer. The results of the studies which the United States Geological Survey has made of the consumption of coal per kilowatt-hour of electrical energy manufactured point to large gains in the efficient operation of the boiler room. A saving of almost three-quarters of a pound of coal per kilowatt-hour means not only cheaper production of power, but also a saving of many millions of tons of coal annually. Not only is the industry itself deriving large results from the more efficient consumption of coal, but the industry is rendering large service to the public in thus conserving fuel. More than nineteen million tons of coal were saved in three years by the central station, a quantity of fuel which represents almost two-thirds of the annual consumption of coal by the public utility generating plants of the country, including electric railway plants. The figures indicate that an even higher efficiency in fuel consumption may be expected in the future.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those using these statistics would credit the ELECTRICAL WORLD.

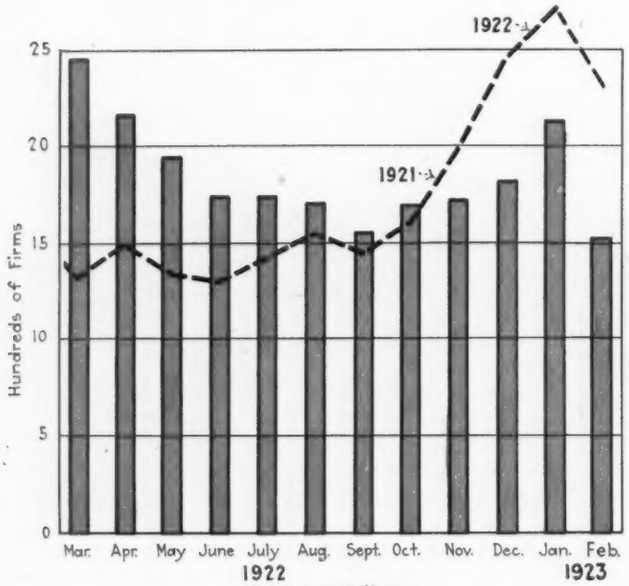
How the Primary Industries Are Trending



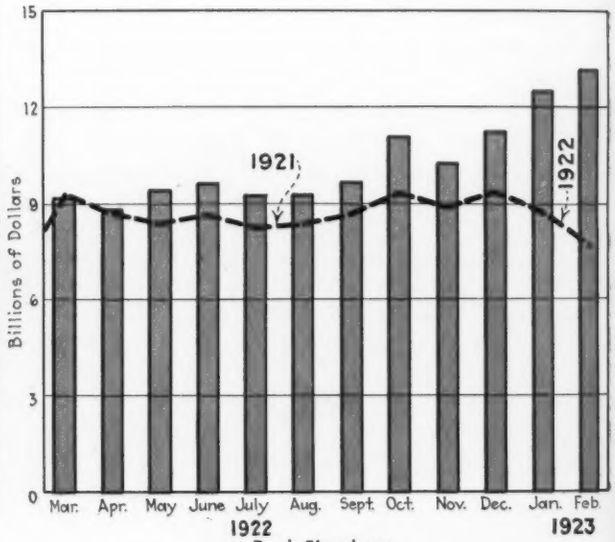
Pig-iron Production



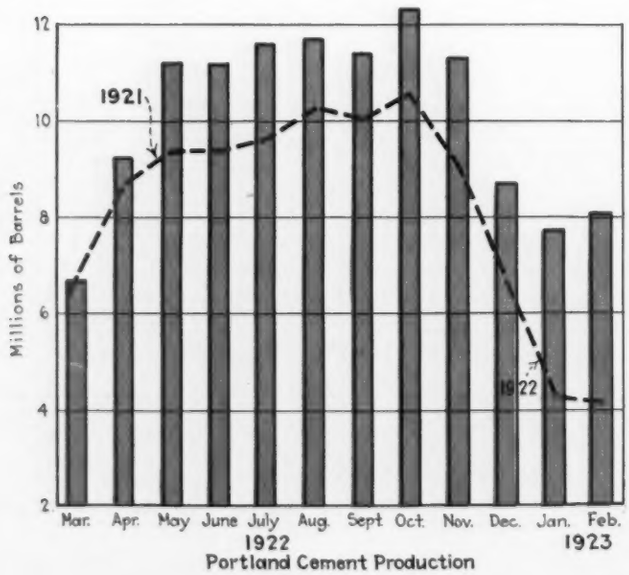
Total Bond Sales, New York Stock Exchange



Business Failures



Bank Clearings
(Outside of New York City)



Portland Cement Production

An Indicator of Record Construction

FEBRUARY being from two to three days shorter than the other months of the year, it is inexpedient to compare the total output of any commodity during February with the output of that commodity during any other month. But the fact that the output of Portland cement during February was almost double that reported for February last year is significant. Cement production in February of last year was almost three and a half million barrels under the January output, while this year the February output is about two hundred thousand barrels over that reported for January. Only a large construction program for the spring throughout the country could call for such large quantities of cement. The record construction witnessed during the past year is evidently in a fair way toward being eclipsed. And a large building program means large purchases of electrical appliances and supplies, and ultimately increased electrical energy requirements.